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Three Essays on Corporate Loans

submitted by

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I. Context and summary of the essays

(Zusatztext)

Ingo Geburtig

I.1 Context of the essays

I.1.1 Leveraged Loans and CLOs

Leveraged loans are corporate loans to borrowers with elevated credit risk. According to the definition of PitchBook (2022), leveraged loans consist of those with a rating of BB+ or lower or a credit spread over LIBOR of at least 125 basis points (bp). In addition to recapitalization and refinancing, leveraged buyouts (LBOs) are a common purpose of leveraged loans (Financial Stability Board, 2019). Private equity (PE) firms therefore play a significant role in this market segment. In 77% of the approximately $1.7 trillion of US leveraged loans outstanding in 2022, the borrower was sponsored by a PE firm (Fitch Ratings, 2023).

In a typical lending process, one or more arrangers syndicate the leveraged loan to many different lenders. In most cases, there are two distinct groups of lenders, each investing in a different type of tranche. Pro-rata tranches are typically syndicated to banks, while collateralized loan obligations (CLOs), mutual funds and other institutional investors provide capital for separate institutional tranches (PitchBook, 2022). Between 2000 and 2022, the mean annual issuance of institutional leveraged loans was $334 billion, slightly exceeding the average volume of newly issued pro rata tranches of $332 billion (Fitch Ratings, 2023).

In the institutional segment, the market shares of the main investor groups have remained relatively constant between 2014 and 2018. CLOs were by far the largest investor group, holding more than 60% of the outstanding volume in each of these years. The second largest group were loan mutual funds, whose share of invested capital was consistently above 20%. The remaining fraction was held primarily by hedge, distressed and high-yield funds, as well as insurance companies (Johnson, 2018). By August 2024, the share of institutional leveraged loans held by CLOs increased to 74%, underscoring their importance as investors in this market segment (Fest, 2025).

CLOs are special purpose vehicles (SPVs) that hold an actively managed portfolio of typically 200-400 different leveraged loans[1] and transform the cash flows of this pool into securities available to investors. Like most other securitizations, CLOs issue multiple tranches that par-

[1] According to Kundu (2023), the 25th (75th) percentile CLO holds 181 (407) loans.

ticipate in the cash flows of the underlying pool in a hierarchical order. While the most senior tranche is paid first, the more junior tranches are compensated by increasingly higher spreads paid over a risk-free benchmark, such as the three-month LIBOR. The most junior debt tranche is typically followed by a subordinate equity tranche. The equity tranche isn't compensated with a fixed rate over LIBOR, but with the excess spread between the leveraged loan portfolio and the debt tranches after additional fees and costs (Kundu, 2023).

Table I.1 shows an example of a typical CLO deal structure as outlined by Martin and Sayrak (2022). The second column illustrates the large difference in spreads between the senior and junior tranches. The senior tranche is by far the largest tranche, accounting for 63% of the total balance. As the rating decreases with seniority, the typical CLO has one tranche per rating letter category.

Table I.1: This table illustrates the capital structure, spreads and ratings of the typical example CLO from Martin and Sayrak (2022). The rating scale refers to S&P and Fitch. Moody's uses a similar rating scale with a lowercase "a" replacing any second or third letter in the other two rating scales.

Tranche	Spread in bp (over LIBOR)	% of Capital	Current Balance (in $mio.)	Original Ratings
A	120	63	315	AAA
B	175	12	60	AA
C	235	6	30	A
D	335	5	25	BBB
E	620	5	25	BB
F	790	1	5	B
Equity		8	40	

Benmelech and Dlugosz (2009) suggest that the relatively uniform structure of CLO deals results from the managers' objective of meeting rating-dependent investor demand at the lowest possible cost. This leads to the question: Who are the CLO investors targeted by the securitization structure? As of December 2018, banks were the largest investor group, holding approximately 28% of the outstanding CLO volume. Insurance corporations and investment funds followed with 18% and 17%, respectively. For 14% of the outstanding volume, the type of investor was unknown. The remainder was held by pension funds and other financial and non-financial organizations (Financial Stability Board, 2019). While banks primarily hold senior CLO tranches, insurance companies also invest in mezzanine tranches. In contrast, CLO equity tranches are mainly held by funds and other investment vehicles (DeMarco et al., 2020).

I.1.2 PE affiliation of CLO managers

CLO managers are responsible for making the investment decisions on the underlying leveraged loan portfolio. Many CLO managers are affiliated with either an investment bank or a private equity firm (Kundu, 2023). Clopremium (2025) provides a list of the 30 largest US CLO managers by assets under management (AuM) as of December 31, 2024. 13 of the 30 managers are either debt arms of primary PE firms or affiliated with asset management groups that are also active in the PE segment. In the following, I use PE group as an umbrella term for all asset managers that operate a PE firm and refer to CLOs affiliated with these asset managers as PE-affiliated.[2]

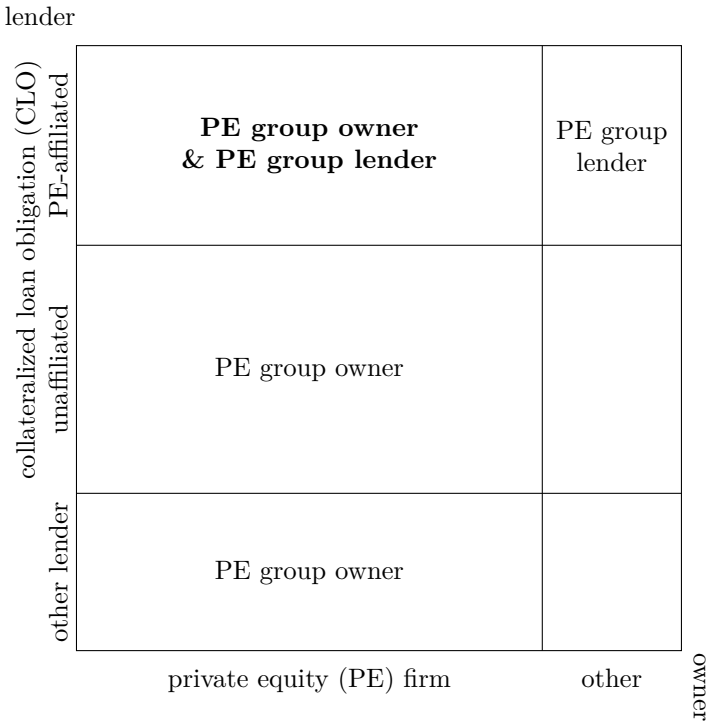
By the end of 2024, the 13 PE-affiliated managers accounted for approximately 44% of the total $655 billion AuM of the top 30 CLO managers, indicating a significant overlap between the CLO and PE business. Assuming that the top 30 CLO managers are representative of the entire market, multiplying this fraction by the 74% CLO share of loan holdings (Fest, 2025) indicates that PE groups account for nearly one-third of the lending in the institutional leveraged loan market. Thus, if the PE affiliation of the lender is uncorrelated with the presence of a PE sponsor in the borrower, the 77% share of PE-sponsored leveraged loans (Fitch Ratings, 2023) implies that about a quarter of the institutional leveraged loan volume is lent by PE groups to borrowers owned by PE groups. Figure I.1 illustrates the significant role of PE groups in the institutional leveraged loan segment.

As a result of the syndication process, institutional leveraged loans typically have many different lenders. For example, in a sample analyzed by Bord and Santos (2015), the average loan tranche with CLO lenders is part of 41 different CLO portfolios. Therefore, the share of institutional leveraged loans with at least one PE group lender is likely much higher than the fraction of leveraged loan volume lent by PE-affiliated CLOs. In some of these cases, the borrowers are sponsored by a PE firm whose affiliated CLOs are among the lenders of the loan.

An illustrative example of this constellation can be found in the context of Carlyle's LBO of

[2]In descending order of CLO AuM, the 13 PE-affiliated CLO managers are Blackstone, Carlyle Group, Ares Management, Blackrock Financial Management, Neuberger Berman, KKR, Blue Owl, Bain Capital Credit, Redding Ridge Asset Management (affiliated with Apollo Global Management), Barings, CVC Credit Partners, Onex Credit Partners and Fortress Investment Group.

Figure I.1: This figure illustrates the loan-volume-weighted share of PE groups among lenders and owners of borrowers in the institutional leveraged loan market. The x-axis is measured at the loan level, with the left fraction representing the loan volume share where the borrower is sponsored by at least one PE firm. The y-axis is measured at the lender level, indicating the fraction of the loan volume lent by (PE-affiliated) CLOs. Assuming that a lender's PE affiliation is uncorrelated with the presence of a PE sponsor in the borrower, the fraction of the area in the top left cell indicates the volume-weighted share of lender-loan relationships where both the owner of the borrower and the lender of the loan are part of a PE group.



the network infrastructure provider CommScope in January 2011 (CommScope, 2011). Carlyle used a loan package consisting of two bank tranches and one institutional facility borrowed by CommScope to finance the LBO. The institutional facility was syndicated to a large number of lenders, including 11 CLOs managed by Carlyle.[3] As a result, Carlyle became both lender and PE sponsor to CommScope. Some academic literature refers to these constellations as dual holdings (e.g. Jiang et al., 2010, Bodnaruk and Rossi, 2016, Yang, 2021).

The first essay in this dissertation is titled *"Dual holdings and shareholder creditor agency conflicts: Evidence from the syndicated loan market"* and examines the company-level implications of the dual holding phenomenon. Typically, shareholders have an incentive to increase the

[3]Loan facility data are from the DealScan database. Data on CLO investments are from Creditflux's CLO-i database. The Carlyle CLOs investing in the CommScope facility used to finance the LBO were Carlyle Arnage CLO, Carlyle Bristol CLO, Carlyle Daytona, Carlyle High Yield Partners VII, VIII and X, Carlyle McLaren CLO, Carlyle Veyron CLO and Mountain Capital CLO IV, V and VI.

level of risk in a company because they participate in the company's profits indefinitely, while potential losses above a certain threshold are passed on to the creditors (Jensen and Meckling, 1976). As described in section I.2.1, the first essay analyzes what loan spreads and prices reveal about the impact of dual holdings on the shareholder-creditor agency conflict. The second essay *"Affiliated investment bias in collateralized loan obligations"* is focused on the CLO level aspects of the overlap in portfolio companies with the managers' affiliated PE firms. It assesses the bias of CLO portfolios towards loans to companies sponsored by PE firms affiliated with the CLO manager. Section I.2.2 briefly outlines that in addition to the magnitude of the overweight, the mechanisms behind the bias are also examined.

I.1.3 Capital requirements for securitizations

As described in section I.1.1, banks are the largest group of CLO investors. A very important determinant of the composition of banks' portfolios is the regulatory capital requirements associated with the assets (e.g. Gropp et al., 2019, Fraisse et al., 2020, Juelsrud and Wold, 2020). The general concept of the capital requirements for banks is described in chapter RBC 20[4] of "The Basel Framework" (Basel Committee on Banking Supervision, 2024). Banks calculate their minimum amounts of Common Equity Tier 1, Tier 1 capital and Total capital by multiplying their risk-weighted assets (RWA) by 4.5%, 6% and 8% (Basel Committee on Banking Supervision, 2024, RBC 20.1).[5] To calculate the total RWA, a bank adds up its RWA for credit risk, market risk and operational risk (Basel Committee on Banking Supervision, 2024, RBC 20.4). In this context, the RWA for securitizations is a subcategory of the RWA for credit risk (Basel Committee on Banking Supervision, 2024, RBC 20.6(4)).

As the Basel Committee on Banking Supervision has no legal authority, the standards of "The Basel Framework" become legally binding only if the legislature of a member state or jurisdictions passes a corresponding law (Viterbo, 2019). In the European Union, the standards

[4]RBC stands for Risk-based capital requirements.

[5]In addition to these capital requirements, banks must hold a capital conservation buffer of 2.5% in Common Equity Tier 1 (Basel Committee on Banking Supervision, 2024, RBC 30.2) and, depending on the level of market-wide credit growth, a countercyclical capital buffer between 0% and 2.5% which is set at the national level (Basel Committee on Banking Supervision, 2024, RBC 30.9). On top of that, banks that are systemically important on the global or domestic level are required to hold an additional capital buffer, the size of which depends on the scope of their systemic importance (Basel Committee on Banking Supervision, 2024, RBC 40).

on capital requirement are mainly implemented by Regulation (EU) No 575/2013, commonly known as the Capital Requirements regulation (CRR) (Deutsche Bundesbank, 2015). In the CRR, securitizations are regulated in Chapter 5 of Part THREE, Title II "Capital Requirements for Credit Risk". This is consistent with the classification of securitization risk as a subcategory of credit risk.

Besides the calculation of the RWA and minimum capital ratios, the CRR also regulates the disclosure of capital requirements. According to Article 438(d) of the CRR, every institute has to disclose all RWA and minimum capital requirements separately for each risk category. Article 449(k) of the CRR explicitly requests that banks disclose the RWA and capital requirements for securitization positions broken down by the regulatory approach used for calculation. The European Banking Authority (2016) provides guidelines for the practical implementation of the disclosure requirements. These guidelines introduce Template EU OV1 for systematic disclosure of RWA and capital requirements by risk category.

In EU OV1, the securitization exposure is a completely separate risk category and, in contrast to the RWA calculation systematic, no subcategory of credit risk. To illustrate the disclosure of capital requirements, Table I.2 presents the Template EU OV1 from Deutsche Bank (2025) as of December 31, 2024. The securitization exposure accounts for approximately 4.5% of the bank's total RWA and capital requirements. This is a relatively small value in comparison to credit risk but in a similar range to market risk, which accounts for approximately 5.3% of total RWA.

In the European Union (EU), the capital requirements for securitization exposures were extensively revised by Regulation (EU) 2017/2401 (European Parliament and Council, 2017), which was adopted in December 2017. The third essay, entitled *"Revisions to the Basel securitization framework and their impact on CLOs"*, examines how the capital requirements for CLO tranches in bank portfolios change as a result of the new regulation. As described in section I.2.3, the essay also analyzes the impact of the changing capital requirements on CLO credit spreads.

Table I.2: This table provides an overview of the RWA in Deutsche Bank's balance sheet as of December 31, 2024. RWA and minimum capital requirements are reported in the format of Template EU OV1 and retrieved from Deutsche Bank (2025). The minimum capital requirements refers to the total capital without any capital buffers (i.e. RWA*8%). The italic positions are subitems of the non-italic positions above. The bold positions refer to the capital requirements for securitization exposure, which are discussed in the third essay.

in € m.	RWA	Minimum capital requirements
Credit risk (excluding CCR)	224,648	17,972
of which:		
The standardized approach (SA)	*19,814*	*1,585*
The foundation IRB (FIRB) approach	*1,029*	*82*
Slotting approach	*313*	*25*
Equities under the simple risk-weighted approach	*10,485*	*839*
The advanced IRB (AIRB) approach	*193,008*	*15,441*
Counterparty credit risk (CCR)	26,521	2,122
of which:		
The standardized approach	*1,209*	*97*
Internal model method (IMM)	*15,189*	*1,215*
Risk exposure to a CCP	*4,531*	*362*
Credit Valuation Adjustment (CVA)	*3,431*	*275*
Other CCR	*2,160*	*173*
Settlement risk	15	1
Securitization exposures in the banking book	**15,970**	**1,278**
of which:		
SEC-IRBA approach	***8,538***	***683***
SEC-ERBA (including IAA)	***648***	***52***
SEC-SA approach	***5,484***	***439***
1250% / deduction	***1,300***	***104***
Market risk	18,965	1,517
of which:		
Standardized approach	*3,359*	*269*
IMA	*15,605*	*1,248*
Large exposures	0	0
Operational risk	58,061	4,645
of which:		
Basic indicator approach	*0*	*0*
Standardized approach	*0*	*0*
Advanced measurement approach	*58,061*	*4,645*
Amounts below the thresholds for deduction (250% risk weight)	13,248	1,060
Total	357,427	28,594

I.2 Summary of the essays

I.2.1 Dual holdings and shareholder-creditor agency conflicts: Evidence from the syndicated loan market

The first essay relates to the shareholder-creditor agency conflict described by Jensen and Meckling (1976). The mechanism for allocating a company's cash flows between equity and debt creates incentives for shareholders to increase the volatility of the company's asset value. Higher asset volatility is associated with an increase in credit risk, which is typically reflected in higher interest rates. A PE sponsor of a company that is affiliated with a CLO manager that lends to the company has a reduced incentive to engage in risk shifting. If creditors anticipate this incentive alignment effect, loans to companies with a dual holding investor should have lower credit spreads than loans to similar non-dual holding companies.

To test this hypothesis, the credit spreads of newly issued leveraged loans are regressed on a dummy variable indicating whether the borrower has at least one dual holding investor. The dual holding status of a borrower is determined by combining sponsor data from DealScan with CLO holding data from Creditflux's CLO-i. The most comprehensive regression model indicates a 32 bp lower credit spread for loans to borrowers with a dual holding investor. The results of spread regressions on various subsamples with different risk shifting sensitivities support the hypothesis of incentive alignment as the driving factor behind the spread reduction.

CLO manager takeovers by PE groups are used to mitigate endogeneity concerns in the spread regression. Since it is unlikely that CLO manager takeover decisions are based on a specific position in the CLO portfolio, changes in companies' dual holding status resulting from these events are used as a quasi-experimental setting. Around the time of the takeover, the secondary market prices of loans to companies with newly emerging dual holding status increased relative to matched control loans. The lower spreads-to-maturity associated with the price increase indicate a reduced credit risk on the same loan facility in the presence of a dual holding investor.

The final section of the essay evaluates the returns of CLO investments in portfolio companies of affiliated PE firms. On average, these trades outperform unaffiliated trades. Interaction

effects with proxies for information sensitivity suggest that information spillover from the affiliated PE firm is the reason for the excess returns.

I.2.2 Affiliated investment bias in collateralized loan obligations

The second essay examines whether CLO managers tilt their portfolios towards loans to companies sponsored by affiliated PF firms. A comparison with a benchmark of matched CLOs with similar characteristics indicates a more than twofold overweighting of affiliated investments at the portfolio level. At the trade level, the probability that a CLO will purchase an available loan increases by 30%-35% of the unconditional purchase probability if the borrower is sponsored by a PE firm affiliated with the CLO manager.

Having established that CLOs have a bias towards affiliated loan investments, the remainder of the essay explores potential mechanisms behind this bias. A more detailed trade-level analysis shows that the affiliated investment bias occurs almost exclusively in the primary market. Thus, the mechanisms behind the bias should also operate primarily in the primary market. One hypothesis specifically related to the primary market is that PE firms use affiliated CLOs as a funding support mechanism to reduce credit spreads on newly issued loans. Consistent with this hypothesis, the affiliated investment bias is particularly pronounced during periods of unfavorable financing conditions, when the need for funding support is at its highest.

Instead of investment decisions by the CLO manager, the affiliation bias in the primary market could also result from preferential allocations in oversubscribed loans by the arrangers. The essay describes two possible explanations for preferential allocations. First, CLO managers affiliated with the PE sponsor of the loan issuer may have an informational advantage on the loan value as a result of information spillovers. Bookbuilding theory suggests that arrangers allocate underpriced securities to highly informed bidders to incentivize them to reveal private information about the value of the issue (Benveniste and Spindt, 1989). In line with the higher value of private information, the affiliated investment bias increases with a proxy for pre-issue price uncertainty.

A second strand of underwriting theory argues that arrangers use preferential allocations as a mechanism to reward bidders for generating revenue in different business segments of the

arranger (Loughran and Ritter, 2002). In the case of loan underwriting, PE firms could be rewarded for their choice of arranger through preferential allocations to affiliated CLO managers. The reward mechanism should incentivize the PE firm to maintain a close business relationship with the arranger in the future. Consistent with the higher importance of the business relationship, the affiliated investment bias is positively related to the prior loan issuance of the arranger-PE firm combination.

I.2.3 Revisions to the Basel securitization framework and their impact on CLOs

The third essay discusses the impact of the revisions to the Basel securitization framework on CLOs. The framework revisions were implemented in the EU by Regulation (EU) 2017/2401 (European Parliament and Council, 2017). Under the revised framework, there are three approaches for determining the risk weight of a securitization position. The only approach that still relies on the rating of the tranche is the external ratings based approach (SEC-ERBA). Both the internal ratings based approach (SEC-IRBA) and the standardized approach (SEC-SA) combine the hypothetical risk weight of the non-securitized underlying with parameters of the securitization's capital structure to determine the risk weight of a tranche. In both the SEC-IRBA and SEC-SA the attachment point is the parameter to which the risk weight is most sensitive.[6]

Overall, the risk weights of typical CLO tranches are higher under the new framework, with the largest increase when the SEC-SA is used to determine the risk weight. The increase in risk weights would be expected to result in higher credit spreads on CLO tranches. However, a difference-in-differences analysis comparing the change in CLO credit spreads in Europe and the US, which weren't affected by the framework revisions, shows no relative spread increase for European CLOs. These results are consistent with a strand of the literature that finds limited costs of regulatory capital requirements for banks (Kisin and Manela, 2016, Plosser and Santos, 2024).

[6]The attachment point is the threshold at which losses in the underlying begin to be allocated to a securitization tranche.

I. References

Basel Committee on Banking Supervision (2024). The basel framework. Consolidated version as of November 27, 2024. Available at https://www.bis.org/basel_framework/. Accessed: January 19, 2025.

Benmelech, E. and J. Dlugosz (2009). The alchemy of cdo credit ratings. *Journal of Monetary Economics 56*(5), 617–634.

Benveniste, L. M. and P. A. Spindt (1989). How investment bankers determine the offer price and allocation of new issues. *Journal of financial Economics 24*(2), 343–361.

Bodnaruk, A. and M. Rossi (2016). Dual ownership, returns, and voting in mergers. *Journal of Financial Economics 120*(1), 58–80.

Bord, V. M. and J. A. Santos (2015). Does securitization of corporate loans lead to riskier lending? *Journal of Money, Credit and Banking 47*(2-3), 415–444.

Clopremium (2025). Top 30 largest us clo managers by aum revealed (updated). Available at https://clopremium.co.uk/top-30-largest-us-clo-managers-by-aum-revealed. Accessed: April 26, 2025.

CommScope (2011). The carlyle group completes acquisition of commscope. Available at https://www.commscope.com/press-releases/2011/the-carlyle-group-completes-acquisition-of-commscope/. Accessed: April 30, 2025.

CRR. Regulation (EU) No 575/2013. Consolidated version as of July 9, 2024.

DeMarco, L., E. Liu, and T. Schmidt-Eisenlohr (2020). Who owns u.s. clo securities? an update by tranche. Available at https://www.federalreserve.gov/econres/notes/feds-notes/who-owns-us-clo-securities-an-update-by-tranche-20200625.html. Accessed: September 26, 2024.

Deutsche Bank (2025). Pillar 3 report 2024. Available at https://investor-relations.db.

com/files/documents/regulatory-reporting/Pillar-3-Report-2024.pdf?language_id=1. Accessed: April 5, 2025.

Deutsche Bundesbank (2015). Ergebnisse des basel iii monitoring für deutsche institute. Available at https://www.bundesbank.de/resource/blob/598380/06c19d946acfdab5ec8f4a4f0577ff6a/472B63F073F071307366337C94F8C870/2014-06-basel3-monitoring-deutsche-institute-data.pdf. Accessed: February 26, 2025.

European Banking Authority (2016). Guidelines on disclosure requirements under part eight of regulation (eu) no 575/2013. Available at https://www.eba.europa.eu/sites/default/files/documents/10180/1696202/20370623-9400-4b5e-ae22-08e5baf4b841/Final%20report%20on%20the%20Guidelines%20on%20disclosure%20requirements%20under%20Part%20Eight%20of%20Regulation%20575%202013%20%28EBA-GL-2016-11%29.pdf. Accessed: March 18, 2025.

European Parliament and Council (2017). Regulation (EU) 2017/2401.

Fest, G. (2025). 2025 us clo outlook: Another gangbusters year expected. Available at https://pitchbook.com/news/articles/2025-us-clo-outlook-another-gangbusters-year-expected. Accessed: April 27, 2025.

Financial Stability Board (2019). Vulnerabilities associated with leveraged loans and collateralised loan obligations. Available at https://www.fsb.org/uploads/P191219.pdf. Accessed: February 8, 2023.

Fitch Ratings (2023). The 2023 annual manual: A primer on the u.s. leveraged finance market. Available at https://your.fitch.group/rs/732-CKH-767/images/The-2023-Annual-Manual-%28A-Primer-on-the-U.S.-Leveraged-Finance-Market%29_10229378.pdf. Accessed: September 25, 2024.

Fraisse, H., M. Lé, and D. Thesmar (2020). The real effects of bank capital requirements. *Management Science 66*(1), 5–23.

Gropp, R., T. Mosk, S. Ongena, and C. Wix (2019). Banks response to higher capital requirements: Evidence from a quasi-natural experiment. *The Review of Financial Studies 32*(1), 266–299.

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.

Jiang, W., K. Li, and P. Shao (2010). When shareholders are creditors: Effects of the simultaneous holding of equity and debt by non-commercial banking institutions. *Review of Financial Studies 23*(10), 3595–3637.

Johnson, J. (2018). Leveraged bank loans primer. Available at https://content.naic.org/sites/default/files/capital-markets-primer-leveraged-bank-loans.pdf. Accessed: April 16, 2025.

Juelsrud, R. E. and E. G. Wold (2020). Risk-weighted capital requirements and portfolio rebalancing. *Journal of Financial Intermediation 41*, 100806.

Kisin, R. and A. Manela (2016). The shadow cost of bank capital requirements. *The Review of Financial Studies 29*(7), 1780–1820.

Kundu, S. (2023). The anatomy of corporate securitizations and contract design. *Journal of Corporate Finance 81*, Article 102195.

Loughran, T. and J. R. Ritter (2002). Why don't issuers get upset about leaving money on the table in ipos? *The Review of Financial Studies 15*(2), 413–444.

Martin, J. and A. Sayrak (2022). Collateralized loan obligations: A primer. *Journal of Applied Corporate Finance 34*(3), 35–50.

PitchBook (2022). Leveraged commentary & data (lcd): Leveraged loan primer. Available at https://pitchbook.com/news/reports/2022-leveraged-commentary-data-lcd-leveraged-loan-primer. Accessed: February 4, 2025.

Plosser, M. C. and J. A. Santos (2024). The cost of bank regulatory capital. *The Review of Financial Studies 37*(3), 685–726.

Viterbo, A. (2019). The european union in the transnational financial regulatory arena: The case of the basel committee on banking supervision. *Journal of International Economic Law 22*(2), 205–228.

Yang, H. (2021). Institutional dual holdings and risk-shifting: Evidence from corporate innovation. *Journal of Corporate Finance 70*, 102088.

II. Dual holdings and shareholder-creditor agency conflicts: Evidence from the syndicated loan market

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Abstract

We examine implications from the expansion of private equity (PE) firms into the CLO (i.e. leveraged lending) business. Due to similarities in the investment universes of CLO managers and PE firms, asset management groups running both of them frequently hold debt and equity claims of the same company. Our results indicate lower credit costs for these companies through mitigation of shareholder-creditor agency conflicts. The lower funding costs imply increased equity returns for the sponsoring PE firms. In addition, our findings suggest that PE-affiliated CLO managers benefit from informed trading in the secondary leveraged loan market.

Keywords: Syndicated loans, private equity, conflicts of interest, private information, credit costs

JEL Classification: G14, G23, G32

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II.1 Introduction

After the financial crisis 2007-08, a new trend has been observed on Wall Street: the joint operation of private equity (PE) firms and collateralized loan obligation (CLO)[1] managers within the same asset management group. Specifically, either through the acquisition of existing or through the foundation of new CLO managers, a large number of groups, who are running well-known PE firms, have been expanding into the institutional leveraged loan market. We refer to CLO managers belonging to the same asset management group as a PE firm as *PE-affiliated*. Through their steady growth during the 2010s, these managers became dominant actors in the CLO business,[2] enabling them to generate a liquid market for the leveraged loans that are financing the buyout activities of their affiliated PE firms (Martellozzo et al., 2019). During our sample period, the Blackstone Group, for example, nearly doubled its CLO AuM from approximately 8 to almost 16 billion USD. Similar patterns can be found for Carlyle, KKR and numerous other PE firms.

CLOs are the largest investor group in the institutional leveraged loan market, estimated to hold about half of the outstanding credit amount in this segment (Financial Stability Board, 2019). Regarding the equity holders, approximately 60% of the leveraged loans are issued by PE sponsored companies (Kakouris, 2022). These two facts suggest that the outstanding loans of PE sponsored companies are often part of CLO portfolios. For PE-affiliated CLO managers, this means that some of the portfolio loans are issued by companies sponsored by PE firms, which belong to the same asset management group as the CLO managers themselves. In these cases, the group becomes a simultaneous debt and equity holder of the company. In related literature (e.g. Jiang et al., 2010, Chu, 2018, Antón and Lin, 2020), this situation is referred to as a *dual holding*.

Analyzing the portfolios of large PE-affiliated CLO managers shows that dual holdings are

[1] Collateralized loan obligations (CLOs) are asset-backed securities that transfer cash flows from leveraged loans to investors. Their liability structure consists of several tranches with decreasing seniority and increasing yield. In their portfolios, they hold mostly leveraged loans, which bear an elevated default risk and pay higher spreads as compensation. For more information on the structure and functionality of CLOs see Martin and Sayrak (2022).

[2] Blackstone and Carlyle, for example, were even the two largest CLO managers by assets under management (AuM) in 2022 (Clopremium, 2022).

indeed a common phenomenon. In our sample, CLO managers belonging to the Blackstone Group, for example, hold on average about 9.9% (or 37 million USD per CLO) of their AuM in debt instruments (loans and bonds) issued by companies owned by Blackstone's PE firm. The corresponding average dual holdings by Carlyle and KKR CLOs are 10.5% (42 million USD) and 17.7% (72 million USD) of the total portfolio amount.[3]

After having established the economically significant role of dual holdings, we aim to identify resulting implications on the leveraged loan market. Due to their different participation from a company's cash flow, equity and debt holders have diverging interests regarding the company's strategical orientation and its operational implementation. Jensen and Meckling (1976) show that as a result, equity holders choose riskier investment projects as debt holders would prefer and as it would be in line with the aim of maximizing the value of the company's total capital. Another area where the incentives of equity holders are not in alignment with the interests of debt holders is the payout policy. The shareholders can transfer wealth from the creditors to themselves by increasing dividends (Smith and Warner, 1979). This agency problem increases the cost of capital for the company, as debt holders will anticipate the shareholders behavior and thus demand higher yields on their loans (Jensen and Meckling, 1976). In situations where the equity sponsor is connected to a debt holder of the company, the agency conflict may decrease.

Consistent with this hypothesis, Chu (2018) finds reduced dividend payouts for companies with shareholding creditors. As a result, interest rates for debt should be lower in these settings. Therefore, we expect that a company has to pay lower credit spreads if at least one of its loans is among the portfolio holdings of a CLO manager belonging to the same group as a PE firm sponsoring the company. We are referring to this implication as the *incentive alignment hypothesis*. In line with the incentive alignment hypothesis Jiang et al. (2010) find 18-32 basis points (bp) lower spreads in syndicated loans to publicly listed companies if one of the lending banks is also a shareholder of the company. Similarly, for loans financing PE transactions, Buchner et al. (2022) discover a 160 bp spread reduction if the creditor is a debt fund affiliated to the PE firm conducting the transaction.

[3] An anecdotal example for the important role of dual holdings in the leveraged loan market is Blackstone's takeover of Refinitiv in 2018. As there were rumors that it could be difficult to finance the takeover, CLOs managed by Blackstone itself were the largest buyers of the loans taken out to finance the deal (Gore, 2019).

We start our investigation of the incentive alignment hypothesis by introducing a novel proxy for the total cost of borrowing (the *Effective Spread*) that explicitly allows for the fact that a large number of institutional leveraged loan facilities 'is issued at a discount to par (original issue discount — OID). While previous research on loan pricing relies almost exclusively on the All-In-Spread-Drawn (*AISD*), we argue and provide supporting evidence that the *AISD* alone is an incomplete and likely misleading measure of borrowing cost.[4] In our sample of institutional loan facilities from DealScan, the *AISD* underestimates effective borrowing costs by 22 bp on average, and the bias even exceeds 50 bp for 10% of the facilities.[5]

We then proceed by regressing the loan spread at issuance on a dummy that indicates whether the issuing company exhibits a dual holding and several control variables. In our most comprehensive regression model, the results indicate a 32 bp lower *Effective Spread* for loan facilities issued by dual holding companies, with only little deviations in the other model specifications.

While these findings are in line with the incentive alignment hypothesis, there are also different interpretations for the negative relationship between dual holdings and spreads in the existing literature. Buchner et al. (2022) interpret the lower spreads in dual holdings as an interest rebate, that debt funds give to portfolio companies from their affiliated PE firms. We conduct several regressions on subsamples with higher and lower risk shifting and interest rebate sensitivity. The spread reduction is especially pronounced in samples that are highly sensitive to risk shifting, whereas we can't find a similar relationship for the rebate sensitivity. We see this as additional evidence for the incentive alignment hypothesis as driving factor behind the debt funding cost reduction for companies with dual holding investors.

Although we use a wide range of control variables, it is still possible that the spread reduction is in fact caused by other unobserved factors that are positively related to the existence of a dual holding and negatively related to the loan spread or vice versa. In section II.3.2 we address these endogeneity concerns, using CLO manager takeovers as quasi-experimental setting. If an asset

[4]The *AISD* is defined as the sum of the spread over LIBOR or EURIBOR plus the facility fee.

[5]Berg et al. (2016) note that upfront fees and the OID are conceptually the same. These authors further report that upfront fee information is largely missing in DealScan and that this deficiency is likely non-ignorable. Since we do not rely on DealScan data to calculate the OID, our research is not subject to any shortcomings resulting from DealScan's limited coverage of upfront fees.

management group which runs a PE firm acquires a CLO manager, some issuing companies of the CLO portfolio loans see a switch in their dual holding status. As it is highly unlikely that CLO manager takeover decisions are related to a specific portfolio loan, we expect no relation between the emergence of the dual holding status and any characteristic of the loan facility or its issuing company. To identify the relationship between dual holdings and credit cost, we observe the secondary market price changes of outstanding loan facilities issued by companies with an emerging dual holding exogenously caused by the takeover. As the relation of loan prices and yields (to maturity) is inverse, an increasing loan price would indicate lower credit cost for the company. We control for time-varying factors influencing the loan price by using the simultaneous secondary market price development of three matched control loans with no change in dual holding status as benchmark. We find on average a 0.88% to 1.45% higher price return after the newly established dual holding status compared to the control loans in the two months around the takeover which increases to 2% to 2.59% if we add four more months after the event. The results of the quasi-experiment provide further evidence for the incentive alignment effect of dual holdings.

Following the examination of the spread reduction, we briefly discuss the economic effects of dual holdings in one of the most important CLO business segments – the funding of leveraged buyouts (LBO). Using a ceteris paribus approach, we calculate a 73 bp higher IRR for an LBO with a typical capital structure.

In the final section, we observe an additional implication of dual holdings. If the PE firm and CLO manager of an asset management group hold equity claims and loans of the same company, there could be private information spillover enabling the CLO manager to profitably trade in the secondary loan market. To investigate this effect, we look at round-trip trades (trades with a buy and at least one subsequent sale) executed by dual and non-dual holders. We adjust realized (net) price returns of round-trips for general market conditions by subtracting the contemporaneous price return of the Leveraged Loan Index[6] from the raw trade return.

The baseline results indicate that dual holding round-trip trades outperform their non-dual

[6]The Morningstar LSTA Leveraged Loan Index (formally known as S&P LSTA Leveraged Loan Index) uses data from PitchBook and LCD to cover the development of the Leveraged Loan market. For detailed information on the construction of the US and Euro Leveraged Loan index see Morningstar (2022) and Morningstar (2023).

holding peers by between 2.8–4.1% in terms of annualized excess returns, conditional on facility and trade-level controls. Furthermore, the average CLO manager generates an additional return of 3.3-4.2% per year from loan investments as a dual holder compared to trades as a non-dual holder. In addition, dual holding trades outperform non-dual holding trades in the *same* borrowing company by 2.2-2.6% per year. These findings demonstrate that CLO managers have substantial timing and facility selection abilities with respect to issuing companies sponsored by their affiliated PE firms. Positive interaction effects between excess returns and three different information sensitivity proxies strengthen the interpretation of information spillover from PE firms to their affiliated CLO managers as major cause of the measured outperformance in dual holding trades. Additional analyses provide evidence against private information about upcoming rating changes as mechanism behind the excess returns.

Our paper contributes to the growing body of empirical literature on dual holdings as channel to reduce the shareholder-creditor conflict of interest prominently introduced by Jensen and Meckling (1976) and Myers (1977). Chu (2018) indicates a more conservative payout policy after the merger of a shareholder and a creditor of the same company. Antón and Lin (2020) show that the presence of dual holders mitigates over- and underinvestment. As a result, the company's borrowing conditions improve. Jiang et al. (2010) show a reduction in syndicated loan spreads if non-commercial banks hold stocks and loans of the same company. Chava et al. (2019) find that a dual holding is associated with a lower probability of capital expenditure restrictions in the loan contract. Chen et al. (2023) discover an attenuating effect of dual holdings on the loan spread increase associated to proxy contests in companies.

We differ from past work in that we focus on syndicated loan (and not equity or bond) investments of CLO managers affiliated with PE firms (not commercial banks or private debt funds). This way, we make important contributions in terms of the markets and data analyzed. Specifically, while most other studies rely on publicly traded companies, we shed light on the much less covered market for non-listed firms. As PE firms usually own a much larger share of the voting rights in their holding companies than for example commercial banks, they have a greater ability to mitigate agency risks if they are incentivized to do so. Furthermore, since PE firms' portfolio companies typically have a high default risk, creditor-shareholder conflicts

are in principle pronounced in this market segment. On the other hand, the high relevance of a PE firm's reputational capital towards creditors for future financing activities might reduce the severity of interest misalignment between private equity and debt investors.

In comparison with the (to the best of our knowledge) only other paper that analyzes the effect of dual holdings in private companies by Buchner et al. (2022), our sample has vastly different characteristics. While our average loan spread is much smaller (392 vs. 800 bp), the facility amount is significantly higher (524.76 vs. 21.9 million USD). Moreover, Buchner et al. (2022) interpret the lower credit spreads as a method of wealth transfer from the debt to the equity fund of the asset management group. Due to our quite opposing incentive alignment hypothesis the spread reduction in dual holdings is rather an effect of the reduced shareholder-creditor conflict instead of its exploitation by the equity side. We substantiate our inventive alignment hypothesis by analyzing the spread reduction in different separate subsamples and utilizing CLO manager takeovers as quasi-experimental setting for variation in the dual holding status.

Our additional results add to the literature on spillover effects between different business units within the same asset management group. Various other authors discovered evidence of informational spillover and informed trading in equity markets (see for example Bodnaruk et al., 2009; Bushman et al., 2010; Ivashina and Sun, 2011b; and Massoud et al., 2011). To the best of our knowledge, we are the first to study how PE information translates into activities on the syndicated loan market, a market that is – compared to the equity market – much less known but more important in terms of size.

II.2 Conceptual Framework

II.2.1 Hypothesis Development

Jensen and Meckling (1976) popularized the concept of risk-shifting through equity holders. As residual claimants of the company, the equity holders indefinitely participate in the company's profits. Their liability on the other hand is limited, since after reaching the inability to satisfy the creditors' claims, all additional losses are born by the company's debt holders. This payoff

structure incentivizes the equity holder to increase the risk above the level that would be optimal to maximize the expected asset value of the company.

Let us use a simplistic example to illustrate the underlying effect of wealth transfer from debt to equity holders. Consider a risk-neutral PE firm owning 100 % of the equity in a company. The company can realize two possible projects, each of which leads to a specific asset value at the end of the following period. After the period, the PE firm uses the generated asset value to repay the company's debt and plans to liquidate or sell the company, receiving the remaining asset value as cash flow. Assuming no additional liability for the company, the PE firm receives the following payout at the end of the period:

$$\text{Payout}_{\text{PE firm}} = \max(\text{Asset Value}_{\text{Company}} - \text{Debt}_{\text{Company}}, 0) \tag{1}$$

With regard to the projects, the company can either realize P_{save} or P_{risky}. P_{save} leads to a certain asset value of 2. P_{risky} on the other hand has a 35 % chance of yielding an asset value of 4 but also a 65 % probability of resulting in an asset value of 0 at the end of the period. Under risk neutrality, it is obvious that P_{save} with a certain asset value of 2 is superior to P_{risky} with an expected value of 1.4 from an overall perspective. However, disregarding potential reputational effects, the equity owning PE firm would rather maximize their own expected payout instead of the company's asset value. Assuming a debt repayment (including interest) of 1 due at the end of the period, the two possible projects would result in the following expected payouts for the PE firm:

$$\text{Exp. Payout}_{\text{P save}} = 2 - 1 = 1 \tag{2}$$

$$\text{Exp. Payout}_{\text{P risky}} = 0.35 * (4 - 1) = 1.05 \tag{3}$$

Hence, in this constellation, the risk-neutral equity holder would prefer P_{risky} over P_{save} due to its higher expected payout. In the real world, it is very difficult to observe this kind of risk shifting activity directly, as the possible investment decisions are unknown for outsiders of the company. However, using the relation between investment and volatility Eisdorfer (2008) finds evidence for the presence of risk shifting in distressed companies.

The superiority of P_{risky} from the equity holder's perspective is based on the fact, that below the threshold of 1 negative deviations of the asset value are entirely passed on to the debt holders of the company. Setting aside reputational concerns, these losses are irrelevant from the equity's perspective. This changes if some of the company's creditors are affiliated to the PE firm sponsoring the company. Continuing with our simplistic example, we introduce an asset management group owning the PE firm as well as a CLO manager, which holds 10% of the company's debt in its portfolio. The combined payout for this dual holding group at the end of the period would be determined by the following function:

$$\begin{aligned} \text{Payout}_{\text{Group}} =& \max(\text{Asset Value}_{\text{Company}} - \text{Debt}_{\text{Company}}, 0) \\ &+ 0.1 * \min(\text{Debt}_{\text{Company}},\ \text{Asset Value}_{\text{Company}}) \end{aligned} \tag{4}$$

In the setting mentioned above this would lead to the following expected payouts for the group:

$$\text{Exp. Payout}_{\text{P save}} = 2 - 1 + 0.1 * 1 = 1.1 \tag{5}$$

$$\text{Exp. Payout}_{\text{P risky}} = 0.35 * (4 - 1 + 0.1 * 1) = 1.085 \tag{6}$$

Due to the partial internalization of the negative asset value deviation below the level of debt repayment, P_{save} has now a higher expected payout, which aligns the incentives on the equity and the debt side of the company and prevents the PE firm from realizing P_{risky}. This does not only increase the overall expected value of the company's assets, but also lowers (in this specific example even eliminates) the credit risk for the debt holders.

Having set the theoretical framework for a credit-risk reduction through dual holdings, we aim to find a measurement to observe this effect. The relationship between interest rate and credit risk is well established in economic literature. The structural model by Merton (1974) and Black and Scholes (1973) is based on the idea, that the pricing of risky corporate debt is only determined by the risk-free interest until the debt matures and the expected credit loss, i.e. the probability of default and the loss given default. Longstaff and Schwartz (1995) have extended the model, making it applicable to floating rate debt, the typical form of credit pricing in leveraged loans.

The tight connection between credit risk and spreads is not only theoretically founded, but also supported by empirical evidence. Huang and Huang (2012) show that calibrating the Longstaff and Schwartz (1995) model with values derived from historical rating class averages can explain 73-95 % of the spread from B rated corporate bonds over risk-free treasuries with the same maturity. On the single bond level, Nozawa (2017) finds that for corporate bonds rated B or below, a 1 unit increase in credit spread is associated with 0.89 additional units of credit loss. This implies that within the high-yield segment, changes in credit spreads largely reflect increased credit risk.[7]

Combining the relationship of credit risk with loan spreads and dual holdings, credit spreads for companies with a dual holding investor should be lower compared to otherwise equivalent companies. As described in the following sections, we generate a dummy indicating the presence of a dual holding investor in the borrowing company for a data set of newly issued leveraged loans. Afterwards, we regress two different loan spread measurements on this *Dual Holding* dummy and several control variables. Under the incentive alignment hypothesis, we expect a negative coefficient of *Dual Holding* representing lower credit risk due to a less intense shareholder-creditor agency conflict.

II.2.2 Empirical setting and prior evidence

In related literature, using a sample of syndicated loans to publicly listed companies, Jiang et al. (2010) discover that if a bank is both, shareholder of the company and member of the loan syndicate, credit quality improves and spreads decrease by 18-32 bp. Buchner et al. (2022) even find a 160 bp loan spread reduction in private equity transactions if a debt fund from the same group as the acquiring PE firm (at least partially) funds the deal.

For several reasons, we expect the effect of dual holdings in our sample to defer from the results in previous studies. First, the transfer of expected wealth from debt to equity holders happens especially if there is a meaningful default probability as the company's cash flows are irrelevant for the debt holders as long as it is able (and willing) to repay its debt. On the one

[7] B is the median rating of the leveraged loans in our sample. Note, that the explanatory power of credit risk is much lower for bonds with investment-grade rating, a finding sometimes referred to as "credit spread puzzle" (e.g. Chen et al., 2009).

hand, due to their experience PE firms may have advanced skills in managing financial distress (Hotchkiss et al., 2021). Several empirical studies support this hypothesis by showing a lower default risk for PE-owned companies after IPO-exists (Michala, 2019), if the PE sponsor is experienced (Tykvová and Borell, 2012) or even in general (Wilson and Wright, 2013) compared with otherwise similar non-PE owned companies. A survey of general partners in private debt funds confirms that 58 % of US and 34 % of European investors regard stronger distress recovery due to the sponsor's turnaround experience as an advantage of PE-sponsored loan deals (Block et al., 2023). On the other hand, the capability to manage distress debt increases the likelihood of acquiring companies with higher leverage and bankruptcy risk (Hotchkiss et al., 2021, Sudarsanam et al., 2011). 32 % of US and 43 % of European investors see a higher default probability due to increased leverage as a concern of PE-sponsored loans (Block et al., 2023). Comparing our sample to the public companies in Jiang et al. (2010) this selection effect considerably outweighs any risk reduction through sophisticated management skills of PE firms. The risk difference is reflected by an average loan spread of 164 bp for the public companies vs. 392 bp in our sample.

Buchner et al. (2022) on the other hand analyze loans that are used to finance PE transactions and granted by private debt funds. While CLOs mainly invest in broadly syndicated loans, private debt funds focus mostly on direct lending (Block et al., 2023). The borrowing companies and the loan sizes in the direct lending segment are significantly smaller and the issuers are, unlike in the broadly syndicated market, typically unrated (Fritsch et al., 2022). The much lower facility amount of 21.9 million USD (524.76 million USD in our sample) and higher average loan spread of 800 bp (392 bp) represent this divergence and indicate a higher risk compared to our syndicated CLO portfolio loans. The risk differences indicate a higher effect as in Jiang et al. (2010) and a lower effect as in Buchner et al. (2022) for our sample.

Second, in order to prevent risk shifting, the dual holding asset management group must be sufficiently incentivized as well as capable of influencing the company's actions in the interest of both sides of the capital structure instead of unilaterally favoring the equity side. The incentive to consider the impact on the creditors increases with the share of funding provided by the debt arm of the dual holding group. While the broadly syndicated facilities in our sample on average

consist of 5.19 syndicate members and even more institutional investors, 40% of the loans in the Buchner et al. (2022) sample aren't syndicated at all and the average number of debt investors is only 2.15. This again suggests a smaller spread reduction for our setting compared to Buchner et al. (2022). For the ability to influence the company's decisions, the equity-holding creditor must control a sufficient share of the voting rights. PE firms typically hold a much larger share of their portfolio companies' equity in comparison to investors in publicly listed companies. In Jiang et al. (2010), dual holding banks own on average only 0.67% of the total equity from their borrowing companies. PE firms on the other hand usually control a significant part of the voting rights and are often even majority owners (Fenn et al., 1997). Hence, PE firms have a stronger influence on the management of the company and can assert a financing and investment policy more in line with the interests of the debt holders. Just like the default risk, the higher share of voting rights indicates a larger reduction in the private market than determined for public companies by Jiang et al. (2010).

On the contrary, new debt-financed transactions occur perpetually in a PE firm's portfolio. As PE-owned companies can borrow against their sponsor's reputational capital, bankruptcies heavily influence the ability to fund future deals for the PE firm sponsoring the defaulting company. This leads, ceteris paribus, to a reduced shareholder-creditor conflict in PE owned compared to publicly owned companies (Malenko and Malenko, 2015). The vast majority of responding debt investors in Block et al. (2023) see the signaling based the on sponsor's reputation as an advantage, improving the quality of loans to PE owned companies. A number of empirical papers support these considerations. Harford and Kolasinski (2014) find no relation between the payouts to PE sponsors and later bankruptcy or financial distress for a company, which is evidence against excessive dividend distributions as a common vehicle for wealth transfer from debt to equity holders. Meuleman et al. (2022) find that a company is less likely to go bankrupt, if it is part of a PE firm's first time fund or the sponsoring PE firm is raising new capital for other funds during the company's period of financial distress. This indicates that increasing reputational concerns for a PE firm indeed tames the bankruptcy risk in its portfolio companies. Contrary to the leverage and voting right aspects, the findings on reputational risk

imply a smaller dual holding effect in our sample compared to Jiang et al. (2010).[8]

II.2.3 Data and variables

While asset management groups utilize different vehicles to conduct their expansion into the field of private debt, CLOs are among the most important ones. Essentially, a CLO is similar to a managed[9] closed-end fund that invests primarily in the institutional segment of the leveraged loan market and to a lesser extent into high-yield bonds.[10] These investments are financed through the issuance of several debt and (one or two) equity tranches.

Our major data source covering the European and U.S. CLO markets is Creditflux's CLO-i.[11] CLO-i provides detailed information on CLO portfolio compositions and trading activity. This data is collected from monthly trustee reports that are sourced from CLO managers and investors alike. Although these parties report voluntarily to CLO-i, we believe a selection bias is unlikely to be present due to investor's strong incentives to report about bad-running CLOs. In line with this argument, Liebscher and Mählmann (2017) do not find any indication for an over-representation (underrepresentation) of good (bad) performing CLOs in CLO-i. Importantly, once CLO-i processes a trustee report the *full* sample of trades and holdings in this month is added to their data. Of course, CLO-i does not give a complete picture of the CLO market – neither in the time-series nor in the cross-section. Since CLO-i started covering the market in mid 2008 they tracked a growing number of CLOs but always relied on sources with interest in the CLO. In cases where a manager missed sending out a trustee report to CLO-i the panel exhibits gaps. Moreover, there are cases where the CLO-i team uploaded a trustee report but did not copy trades and holdings into the respective data tables. To fill these gaps to the best possible extent we manually add data whenever we get hands on a trustee report that has not

[8] We thank the anonymous reviewer for the insightful remarks, that inspired us to consider the significant role of reputational risks in the private equity business.

[9] A smaller fraction of the CLO market is not actively managed (balance sheet CLOs). These CLOs are not part of our study.

[10] Under the Volcker Rule CLOs that do not only hold loans are regarded as "covered funds". Because banks are prohibited to invest in these kind of funds CLOs renounce from bond investments nowadays. However, our sample also covers pre-Volcker Rule CLOs whose portfolios consist of bonds to a notable extent.

[11] Several papers use the same database (see for example Benmelech et al., 2012; Liebscher and Mählmann, 2017 and Loumioti and Vasvari, 2019). Liebscher and Mählmann (2017) also detail important institutional features of CLOs and provide a discussion of coverage and selection bias issues potentially associated with CLO-i.

been processed. Appendix II.5 provides an insight into the depth of our sample, in terms of trading activity (monthly number of trades) and CLO portfolio observations. As can be seen, coverage climbs significantly during the year 2008 and remains high thereafter. While we cannot benchmark the trade figures to publicly available data sources covering the overall market, we can compare the portfolio volume of U.S. CLOs in our sample to the USD-denominated outstanding CLO volume as published by the Securities Industry and Financial Markets Association (SIFMA). Using this data as a benchmark, we estimate that over the period 2009-Q1 to 2015-Q4 our sample has an average (median) coverage of 53% (52%).[12]

As described above, our main variable of interest is the *Dual Holding* dummy of newly issued loan facilities. The dummy captures whether a dual holding asset management group exists, that simultaneously holds equity (via a PE firm) and debt (via a CLO manager) of the issuing company. To generate this variable we track the dual holding status of every company occurring as borrower in our dataset on a monthly basis. We than match this list by company and month to our sample of newly issued loans to obtain the *Dual Holding* dummy on the loan facility level. In the time dimension, we use the month after the loan issuance for the matching. This way, we make sure that we not only tag facilities from issuing companies with pre-existing dual holders, but also the ones with an arising dual holding status through CLO investments into the newly issued facility itself.

To generate the list of the monthly dual holding status of the companies, we follow two steps. In a first step, we determine whether a particular CLO manager belongs to the same group as a PE firm. We use information from Fitch Ratings (2014), CLO manager websites and prospectuses downloaded from CLO- to determine the ultimate parent of the CLO manager, and we take particular care of the dynamic nature of this relationship. Overall, we detect 83 PE-affiliated CLO managers, which manage 742 CLOs.

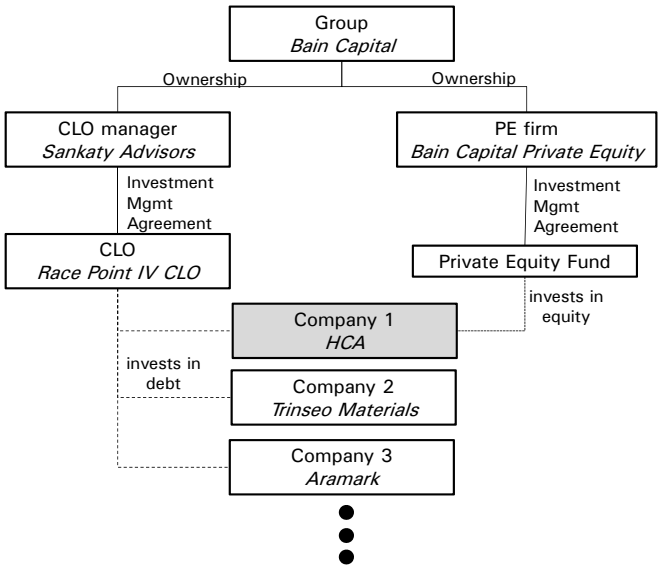
Next, we examine at the company-month level, whether the two sufficient conditions for a positive dual holding status simultaneously occur. First, the company has to be sponsored by a PE firm belonging to an asset management group that also participates in the CLO business.

[12]In the SIFMA data arbitrage and balance sheet CLOs are aggregated suggesting that our estimate of the sample coverage is rather conservative.

Second, an outstanding loan facility issued by the company has to be part of the portfolio holdings of a CLO manager affiliated to this sponsoring PE firm.

We retrieve the information on the portfolio holdings from the CLO-i dataset described above. For the sponsoring relationship, we rely on the DealScan variable *Sponsor* that contains the name of the PE firm, if any, holding the company's equity at the time a new loan is issued. For each company-PE firm combination, we define the issuance date of the first loan facility, where the PE firm is listed as sponsor as the beginning of the equity holding period. For the end of the period, we use either the maturity date of the last facility listing, or the issuance date of the first facility not listing the PE firm as sponsor of the company, whichever comes earlier.

Figure II.1: This figure illustrates the definition of *Dual Holding*. A PE firm (Bain Capital Private Equity) sponsoring a company (HCA Healthcare) belongs to the same asset management group (Bain Capital) as a CLO manager (Sankaty) holding debt of the company via its CLO.



The generation of the *Dual Holding* dummy is best illustrated using an example. The Hospital Corporation of America (HCA) is a healthcare provider, taken private in 2006 by a group of PE firms including Bain Capital Private Equity, the equity arm of the asset management group Bain Capital (Smith and Politi, 2006). In May 2013, HCA issued a new syndicated loan for corporate purposes. During that time, Sankaty Advisors was the debt arm of Bain Capital, managing, among other vehicles, the Race Point IV CLO.[13] In June 2013, the portfolio holdings

[13]Since a rebranding in 2016 Sankaty advisors operates under the name Bain Capital Credit (Donde, 2016).

of Race Point IV CLO included two loan facilities issued by HCA. One of them was the newly issued facility, the other a previously syndicated loan. Thus, Bain Cpaital was simultaneously holding debt and equity of the company (see Figure II.1) and HCA obtains a dual holding status for June 2013.[14] Therefore, the *Dual Holding* dummy of HCAs newly issued loan facility in May 2013 is set to 1. As Table II.1 shows, 13% of all sponsored loan facilities in our sample have a *Dual Holding* dummy of 1, which underlines the practical relevance of dual holdings in the PE market.

Table II.1: This table presents summary statistics for DealScan matched facilities in our CLO trading data. A facility has to be "sponsored" to be eligible for inclusion in our sample. All variables are measured as of the issuance of the facility. We report the mean, standard deviation and median as well as the 10th and 90th percentile to give an overview of the range of occurring values. All variables are described in detail in appendix II.5.

	N	mean	sd	median	p10	p90
AISD	4042	391.77	143.61	375.00	225.00	550.00
Effective Spread	2720	432.66	149.52	412.50	262.50	625.00
Price at Issuance	2720	99.12	1.60	99.50	98.00	100.00
Dual Holding	4042	0.13	0.34	0.00	0.00	1.00
# Syndicate Members	4042	5.19	6.41	4.00	1.00	9.00
# Facilities	4042	1.75	1.20	1.00	1.00	3.00
Facility Amount	4039	524.76	771.62	306.21	80.14	1179.10
Maturity	4011	6.24	1.45	6.04	4.68	7.24
LBO/SBO	4042	0.38	0.49	0.00	0.00	1.00
Secured	4042	0.95	0.22	1.00	1.00	1.00
Performance Pricing	4042	0.11	0.31	0.00	0.00	1.00

In several of our analyses below, we rely on an extensive set of loan characteristics as control variables. Appendix II.5 provides a complete overview on every variable we use in this paper, including the data source, the unit and a short description of its meaning. Since CLO-i contains only limited loan-level information, we match facilities in CLO-i to DealScan using a multi-step approach, which is detailed in the appendix II.5. This matching procedure results in 4,007 DealScan matched *sponsored* facilities with non-missing spread information. Recall that our sample is restricted to sponsored companies because as for an observable dual holding to exist at all, a company has to be sponsored (owned by a PE firm).

[14]Note, that each of the two holdings on its own would have been sufficient to fulfill the criteria for a dual holding status.

We believe that our CLO-i vs. DealScan match, while manually cumbersome, offers the invaluable benefit of providing a wider and cleaner look into the lending activity of CLOs than DealScan alone. Other studies that investigate the role of institutional investors like CLOs in leveraged loans (e.g., Benmelech et al., 2012; Lim et al., 2014) rely solely on the information provided by DealScan to identify lenders in the syndicate. However, the lender composition seems incomplete in DealScan and underrepresents CLOs. The main reason for this incompleteness and the likely bias in DealScan's institutional loan share information is based on the fact that for the majority of loans, DealScan collects this information from regulatory filings that normally contain only the names of the lead underwriters/arrangers of the loan package. Hence, non-lead underwriter institutional investments are systematically missing. This is important in our context since CLOs are never lead arrangers of loan packages.[15]

II.3 Empirical findings

II.3.1 Credit spread analysis

As pointed out above, if loan ownership of equity holders reduces agency conflicts, we expect lower spreads for facilities originated by companies with dual holdings. To examine our hypothesis, we analyze the influence of an own debt holding by at least one of the company's PE firm sponsors on the spread of new issued facilities. We are doing so by examining the existence of a dual holding as described above. We generate a *Dual Holding* dummy that takes the value 1 if the issuing company of a new loan facility exhibits a dual holding the month after the loan issuance and 0 otherwise. This way, we capture dual holdings arising from investments into the new facility as well as pre-existing dual holdings via other outstanding loans. Afterwards, we regress the spread on the *Dual Holding* dummy and an extensive set of controls.

Actual loan pricing within the syndication process is determined through what is called

[15] Our finding of this institutional participation misrepresentation in DealScan is backed by the observation that according to the LSTA, roughly 60% of leveraged loan issuance is financed through CLOs but only a small fraction of sponsored loan facilities in DealScan have a lender in the syndicate classified as CDO (including CLOs), Hedge Fund or other institutional investor ($< 8\%$). Furthermore, Ivashina and Sun (2011b) report that the average loan amendment agreement shows eight more entities than the original syndicate according to DealScan, which is probably the result of an incomplete collection of lender information in DealScan.

"market-flex" in practitioners' jargon. Importantly, while loan amount and non-price terms (maturity, collateral, covenants) are fixed in advance, the spread *and* the price (equivalently, the OID) will either be adjusted ("flexed") up or down during the syndication process depending on demand and general market conditions.[16] A voluminous literature in finance looks at loan pricing by taking the DealScan variable All-In-Spread-Drawn (*AISD*) as a proxy for total borrowing costs (e.g., Jiang et al., 2010; see Berg et al., 2016 and Berg et al., 2017 for notable exceptions).

One important underlying assumption of the *AISD* as cost measure is that loans are issued at par. However, the summary statistics shown in Table II.1 indicate that the *Price at Issuance* is usually below 100. Indeed, the mean price across the whole sample of 2,720 facilities for which we observe purchase prices in the primary market is 99.12, significantly lower than 100. This implies an average price discount of 88 bp. Moreover, the median price is 99.5 and more than two thirds of sample facilities are priced below 100. Price discounts can even become extreme. For example, 10% of facilities are priced at a discount of 200 bp and more! Looking only at the *AISD* would severely underestimate borrowing costs in these cases. Finally, the standard deviation in price discounts (or premiums) is large at about 160 bp. The main takeaway here is that one cannot ignore the price when studying total costs of borrowing, at least not for institutional leveraged loans. This has long-since been recognized by practitioners. They usually add the price discount (called OID – original issue discount – in market jargon) to the spread by assuming an effective maturity for the loan (usually fixed at four years). We follow their approach and define a variable *Effective Spread* exactly this way:

$$\textit{Effective Spread} = \textit{AISD in \%} + \underbrace{(100 - \text{price})/4}_{OID} \tag{7}$$

Hence, for the average facility, yearly effective borrowing costs are 22 bp (over four years) higher than implied by the *AISD*.

For comparison, we run our regression with both, the *AISD* and *Effective Spread* as loan

[16] For more details on how syndicated loan pricing works, see Ivashina and Sun (2011a).

cost proxy. As we gather the *Price at Issuance* from CLO-i, we are missing this information when no CLO purchased the loan facility directly on the primary market. For that reason our sample size is about one third smaller when we regress on the *Effective Spread* compared to the *AISD*. On the other hand, through this forced restriction we control for potential structural differences between loans with and without CLO primary market investments. In case this subsample of loans is simultaneous associated with significantly higher or lower loan spreads and *Dual Holding* rates, we would expect notable differences between the spread regression coefficients due to omitted variable bias in the *AISD* specification.

Our control variables are mostly loan or company specific, motivated by previous studies (e.g., Bharath et al., 2011; Berg et al., 2017; Ivashina and Sun, 2011a; Ivashina and Kovner, 2011) and rely on DealScan data. Table II.1 gives an overview of the descriptive statistics for these variables.

However, the credit spread does not only depend on company or loan specific factors but also on overall market conditions. During some periods, investors demand a higher premium over the risk-free rate to lend money to risky companies than in other times. To control for the overall conditions on the market for debt with elevated risk, we follow Axelson et al. (2013) and use the high yield bond spread over LIBOR. We account for the possibility of a general relation between a facility's loan spread and the probability of a CLO investment in it by controlling for the share of the total facility amount purchased by CLOs on the primary market. To avoid overlaps with the Dual Holding dummy, we only use the investments of unaffiliated CLOs for the purchase volume calculation.

Furthermore, we use fixed effects to control for unobserved variation in several dimensions. We add year dummies for time-varying factors and loan type fixed effects for variation related to the kind of facility. We capture otherwise unobserved risk factors by adding rating letter fixed effects.[17] To control for branch- and country-specific determinants we add industry and country fixed effects. While about 24% of all facilities are issued by companies with only one sponsor, the remaining 76% have two or more different sponsors. Thus, for sponsor fixed effects we build a separate dummy for each distinct sponsor combination (i.e. "Blackstone Group,

[17]For the by far most common rating letter B we use separate dummies for B+, B and B- as rating notch.

CVC Capital Partners") that occurs in our sample.

Table II.2 presents the results, separately for the *Effective Spread* and *AISD* as dependent variables. Consistent with the idea of reduced agency cost, the coefficient on *Dual Holding* is always negative and significant on the 0.1% level. Columns (3) and (1) show a 42 bp lower *AISD* and a 40 bp reduction for the more accurate *Effective Spread* in facilities issued by companies with dual holding PE sponsors.

The signs of the control variable coefficients are mostly in line with previous empirical studies and economic theory. As in Ivashina and Sun (2011a) performance pricing is associated with lower and LBO as loan purpose with higher spreads. Like Ivashina and Kovner (2011) we find a negative relationship between the number of lenders (syndicate members) and loan spreads. The loan maturity is positively related to the spread (in accordance with Berg et al., 2017 and Ivashina and Kovner, 2011) whereas the correlation between the facility amount and the spread is negative (in accordance with Bharath et al., 2011; Berg et al., 2017 and Ivashina and Sun, 2011a). As expected, we also see an increased loan spread when the risk premiums on the HY bond markets are higher. The fact, that the coefficients of the control variables confirm previous findings strengthens our confidence in the general validity of our model and the quality of the data we used.

So far, we mainly used control variables that are either related to a facility's risk or to the overall market conditions to explain the loan spread aside from the dual holding. However, the relationship between the parties participating in the syndication process might also play an important role, especially as leveraged loans aren't traded on public markets. Ivashina and Kovner (2011) find that an intense relationship between a PE firm and the lead arranger, measured by the underwritten loans to companies sponsored by the same PE firm, is associated with lower loan spreads. As the same groups who run the biggest PE firms such as Blackstone, Carlyle and KKR also own some of the largest CLO managers, they likely have both, a strong relationship with the arranging investment banks and many dual holdings via their large PE funds and CLO portfolios. Thus, part of the lower spreads in dual holding facilities could be caused by the PE firm-arranger relationship instead of the incentive alignment effect. To control for this possibility, we add the inflation-adjusted facility amount of all loans that were

Table II.2: This table presents results from spread regressions. The dependent variable is the *Effective Spread* in Columns (1) and (2) or the *AISD* in Columns (3) and (4). The independent variable *Dual Holding* captures whether a PE sponsor of the borrowing company has an affiliated CLO manager investing in at least one of the company's loan facilities. Variables are explained in appendix II.5. The constant is not reported. Standard errors are clustered at the company level with the corresponding p-values reported in parentheses.

	Effective Spread		AISD	
	(1)	(2)	(3)	(4)
Dual Holding	-39.791	-32.372	-41.766	-36.965
	(0.000)	(0.005)	(0.000)	(0.000)
Unaffiliated Funding	-0.451	-0.382	-0.392	-0.359
	(0.006)	(0.013)	(0.004)	(0.008)
Log(# Syndicate Members)	-11.599	-10.887	-14.500	-13.364
	(0.025)	(0.031)	(0.000)	(0.000)
# Facilities	-3.625	-0.566	2.048	3.933
	(0.286)	(0.865)	(0.435)	(0.140)
Log(Facility Amount)	-21.099	-18.584	-19.688	-18.202
	(0.000)	(0.000)	(0.000)	(0.000)
Log(Maturity)	75.589	56.905	80.162	71.937
	(0.000)	(0.000)	(0.000)	(0.000)
LBO/SBO	15.550	-4.186	8.765	-3.577
	(0.026)	(0.561)	(0.094)	(0.526)
Secured	9.183	13.290	-11.798	-10.259
	(0.638)	(0.494)	(0.426)	(0.498)
Performance Pricing	-38.964	-36.266	-32.331	-30.575
	(0.000)	(0.000)	(0.000)	(0.000)
HY bond spread over LIBOR	42.792	41.507	21.602	20.561
	(0.000)	(0.000)	(0.000)	(0.000)
Log(1+5yr Lead-Company-Vol)		-8.296		-4.679
		(0.000)		(0.000)
Log(1+5yr Lead-Sponsor-Vol)		-2.295		-2.029
		(0.167)		(0.106)
Year FE	Yes	Yes	Yes	Yes
Loan Type FE	Yes	Yes	Yes	Yes
Rating Letter FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Sponsor FE	Yes	Yes	Yes	Yes
N	2706	2706	3984	3984
adj. R^2	0.492	0.515	0.488	0.497

issued by portfolio companies of the sponsoring PE firm and underwritten by the same lead arranger as the observed facility to the right-hand side of the equation. Bharath et al. (2011) find that the relationship also plays a role on the company-arranger level. They discover that repeated borrowing from the same creditor results in lower loan spreads for the issuing company. Therefore, we add the inflation-adjusted facility amount of the company previously underwritten by the same lead arranger as the observation facility as control variable. The relationship and market share variables are calculated on a rolling five-year basis prior to the facility issuance.

Columns (2) and (4) show the results of the spread regression with the included relationship variables. The reduction effect through dual holdings decreases to 37 bp for the *AISD* and 32 bp for the *Effective Spread* measure. This result is in line with previous literature indicating that intensive past company-lead arranger relations (Bharath et al., 2011) and past lead arranger-PE firm relations (Ivashina and Kovner, 2011) lower spreads (*AISD*) and the presumption that dual holding facilities are associated with more frequent past interactions. The dual holding effect is comparable to the upper range of the estimates of Jiang et al. (2010) who find that the presence of at least one dual holder reduces syndicated loan spreads (*AISD*) by 18-32 bp and significantly below the 160 bp of Buchner et al. (2022). These results are in line with the diverging default risk, where our sample ranges between the two other ones. Furthermore, it reflects the different portions of outstanding equity and debt owned by the dual holding group and their impact on the manager's capability and incentives to prevent wealth transfers from debt to equity holders.

In appendix II.5 we examine whether large asset management groups, who sponsor dual holding companies to a much higher proportion, are a dominant driver behind the results. However, we find no evidence for an especially pronounced spread reduction effect in the subsample of loans issued by companies with large asset management groups as sponsors.

The results presented in Table II.2 support our hypothesis of better-aligned incentives in companies where some of the creditors are affiliated to the equity sponsors. However, there is a different hypothesis on the rationale behind the spread reduction in dual holding constellations advocated by Buchner et al. (2022). While we interpret the lower spreads as a result of creditors anticipating a mitigation of the post-lending shareholder-creditor conflict, they rather see it as

a manifestation of the agency conflict in the lending process itself. Buchner et al. (2022) view the spread reduction as an interest rebate given by debt funds to companies sponsored by PE firms affiliated with the debt fund. This interest rebate is perceived as a wealth transfer from the debt to the equity investors, which was rationale if the group's exposure to the PE fund's performance is higher than to the debt fund's performance. To find out, which of these two explanations causes the spread reduction in our setting, we conduct several sub-analysis on factors that aim to disentangle *risk shifting sensitivity* from *interest rebate sensitivity*. There are some loan characteristics that heavily increase the possibility and importance of risk shifting but have no obvious connection to the likelihood of wealth transfer through interest rebates.

As described above, loans with higher default risk are associated with a stronger incentive for risk shifting. This conventional wisdom can be substantiated with the corporate debt pricing model developed by Merton (1974). It implies that under certain conditions equity and debt of a company can be regarded as long-call and short-put options on the asset value with the liability amount as strike price. In this framework, a corporate default is equivalent to the long-call option expiring out of the money. When the market value of the assets and the principal amount of the liabilities are similar, the default risk of the company is very high and the asset value options are at the money. In this situation, the options vega factor is especially high, implying a high sensitivity of the option price to changes in the underlying volatility. As higher (asset) volatility benefits the long-call (equity holder) and harms the short-put (debt holder) position the equity holder is incentivized to increase risk especially in a company with a high default probability.

For that reason, we split the sample used in Table II.2 into a subsample with higher and lower default risk. This division happens in two ways. First, we use the average rating by S&P, Moody's and Fitch as basis for the risk assessment. B is the median rating of all loan facilities in the sample. Thus, we take the loans with average ratings B or worse into the high-risk and facilities with ratings B+ or better in the low-risk category. As nearly half of all loans in the sample have an average rating of B and the group of worse-rated as well as the group of better-rated loans each account for only a bit more than a quarter of all loans, the high-risk sample is much larger than the low-risk one despite a median-split by rating. Assuming efficient markets

with rational participants, spread over LIBOR is another way to measure the default risk of a loan facility. Therefore, we separate the sample into loans with an *AISD* of above and below the median of 375 bp.

Barnea et al. (1980) show that the asset volatility of a company has a higher impact on the valuation of long-term debt than short-term debt. Hence, the risk shifting effect through volatility increase should be more pronounced in loans with longer maturity and we expect a larger spread reduction through dual holding in these facilities under the incentive alignment hypothesis. Thus, we split the sample into loans with a maturity of more than six years and six years or less. We use six years as threshold for long-term loans, as it is relatively close to the median loan-maturity in the sample.

Panel A of Table II.3 presents the results of the spread regression on the *Dual Holding* dummy we have used in Table II.2 for the subsamples with high and low risk shifting sensitivity. The reported number is the coefficient for *Dual Holding*, while all other variables from Table II.2 remain in the regression but their coefficients aren't reported. The model refers to the column number in Table II.2 and the coefficients of each sub-analysis are presented in a separate line.

As expected, we see a much more pronounced spread reduction in the high-risk samples compared to the low-risk samples. Using the *Effective Spread* regression with relationship controls (Column (3)), we see a 37 bp reduction for loans with dual holders in the sample with worse ratings and a 36 bp reduction in the high-spread sample. Column (4), on the other hand shows a 29 bp spread reduction for the better ratings- and a 4 bp effect for the low-spread sample. Comparing the loans by term, the dual holding effect on the *Effective Spread* is almost twice as high (38 bp vs. 21 bp) in the facilities with a longer time to maturity. While using other specifications than Model 2 results in slightly diverging coefficients, the difference between the two groups of each sample split has always the same sign and generally a similar magnitude. In summary, we see a larger spread reduction effect for the samples with high risk shifting sensitivity in all three settings.

While risk shifting sensitivity is primarily based on company characteristics, the interest rebate works though additional demand (or, put differently, capital supply) for the issued facility. Unlike Buchner et al. (2022) we don't observe the dual holding phenomenon via PE transaction,

Table II.3: This table presents the results for the *Dual Holding* coefficient from Table II.2 in different settings either related to risk shifting or interest rebate sensitivity. The model number refers to the columns in Table II.2. *Rating* divides the sample into facilities with ratings B or worse (High) and B+ or better (Low). *Spread* breaks the facilities into subsamples with *AISD* of at least (High) or lower than (Low) 375 bp. *Maturity* splits the sample into facilities with a maturity of more (High) and at most (Low) six years. *Aff. Purchase* takes into account whether a portion of the facility is purchased by a CLO manager belonging to the same group as a PE firm sponsoring the borrowing company. The low interest rebate sensitivity subsample excludes all facilities with such an affiliated purchase. The high interest rebate sensitivity subsamples excludes all facilities with a dual holding coefficient of one but no affiliated purchase. *Lender type* shows the *Dual Holding* coefficients for the subsample of loan facilities from Table II.2 with at least one bank loan facility in the same package (High) and the regression results for these related bank facilities (Low). Standard errors are clustered at the company level with the corresponding p-values reported in parentheses.

	Effective Spread					AISD				
	Model 1		Model 2			Model 3		Model 4		
	High	Low	High	Low		High	Low	High	Low	
	(1)	(2)	(3)	(4)	N	(5)	(6)	(7)	(8)	N
A: Risk shifting sensitivity										
Rating	-47.167	-34.631	-37.430	-28.895	High: 1982	-49.558	-19.824	-43.996	-16.655	High: 2955
	(0.000)	(0.056)	(0.008)	(0.109)	Low: 724	(0.000)	(0.152)	(0.000)	(0.240)	Low: 1029
Spread	-41.619	-4.619	-35.630	-3.650	High: 1640	-44.117	-3.263	-40.860	-2.133	High: 2098
	(0.011)	(0.488)	(0.033)	(0.582)	Low: 1066	(0.006)	(0.495)	(0.013)	(0.652)	Low: 1886
Maturity	-43.788	-37.029	-38.258	-21.110	High: 1824	-41.276	-28.896	-37.506	-18.906	High: 2742
	(0.001)	(0.102)	(0.003)	(0.325)	Low: 882	(0.000)	(0.001)	(0.000)	(0.040)	Low: 1242
B: Interest rebate sensitivity										
Aff. Purchase	-38.854	-35.838	-30.102	-28.269	High: 2563	-46.102	-35.330	-41.114	-28.494	High: 3794
	(0.003)	(0.010)	(0.029)	(0.047)	Low: 2416	(0.000)	(0.000)	(0.000)	(0.000)	Low: 3659
Lender type						-39.995	-45.053	-39.052	-40.747	High: 856
						(0.068)	(0.032)	(0.081)	(0.058)	Low: 1146

but use data on the CLO portfolios components. As a result, in 37% of our dual holding facilities, no dual holding group purchases any portion of the newly issued facility. Instead, the dual holding status is solely caused by pre-existing portfolio positions of other outstanding loans to the same company. In these cases, there is no capital supply by a CLO manager affiliated to one of the company's PE sponsors that could be associated with an interest rebate.

In order to isolate the affiliated capital supply effect from the general dual holding effect we build two different subsamples out of the facilities from Table II.2. Both samples consist of the same non-dual holding status facilities, but differ in their dual holding status ones. The highly interest rebate sensitive sample excludes all facilities with a dual holding coefficient of one but no purchases from a CLO manager affiliated to the company's sponsor. In this sample, like in Buchner et al. (2022), the dual holding status means that the loan is to some extend funded by a debt arm of the asset management group operating one of the company's equity sponsors. In the other sample, all facilities with affiliated purchases are excluded. By design, all issuers of the excluded facilities are dual holding companies by the time the loan has been issued. In the remaining sample, none of the dual holding loans is funded by an affiliated CLO manager. Thus, under the interest rebate hypothesis, we would expect no spread difference between the facilities issued by dual holding and non-dual holding companies in this subset.

Risk shifting works on the company level (i.e. affects all facilities of the company to a similar extend), whereas additional demand for a loan reduces the interest rate stronger in the facilities where the demand occurs. Ivashina and Sun (2011a) show that higher institutional demand pressure, both on the market and loan level, lowers the spread of the institutional facilities relative to the bank facilities of the same loan package. We would expect this effect to be especially pronounced under the interest rebate hypothesis, as there is no reason for a bank, to join a CLO manager in giving discounts on the loan spread for portfolio companies of their affiliated PE firms.

To observe the dual holding effect in non-institutional loans, we are examining bank facilities of the same loan package as the institutional facilities in Table II.2. We use DealScan data to identify bank loans in two ways: First, we look for facilities with loan type "Term Loan A" as these facilities are typically syndicated to banks (S&P Global Market Intelligence Inc., 2020).

Second, we use a data file that shows the share of loan allocations distributed to each member of the loan syndicate. If the total bank allocation exceeds 50 % of the facility amount we also define the facility as a bank loan. This way, we identify 1.146 "sibling" bank facilities for 856 of the 3.984 institutional facilities in the total sample. Since we don't observe primary market prices (and thus OIDs) for the bank facilities we can only use the AISD specification as loan cost measurement in this analysis. Furthermore, bank loans typically don't exhibit funding via CLOs. For that reason we omit *Unaffiliated funding* from the set of control variables in both of the samples.

Panel B of Table II.3 presents the estimators for the *Dual Holding* coefficients for the subsamples with high and low interest rebate sensitivity. As in Panel A, the model number refers to the column in Table II.2. The coefficients for the sample without facilities with affiliated purchases (Low) show a statistically significant 28 bp reduction through dual holdings in the models with relationship controls. As these facilities aren't funded by the dual holding asset management group, the interest rebate hypothesis can't explain this effect. The estimators for the dual holding coefficient are 11-13 bp higher in the sample, where all dual holding status facilities are purchased by an affiliated CLO-manager. This difference indicates a slight additional spread reduction through interest rebates from affiliated capital suppliers. However, the difference is very modest in comparison to the overall dual holding effect and hardly appears at all in the more accurate *Effective Spread* specification.

Separating by lender type, we see no relevant difference in the spread reduction effect for the institutional loans, we have used in Table II.2 (High) and their "sibling" bank facilities from the same loan package (Low). Reflecting empirical findings by Ivashina and Sun (2011a), we would expect a lower *Dual Holding* coefficient for the non-institutional tranches, if excess demand by affiliated CLO managers were an important factor in the price building of loans to dual holding companies. In conclusion, our subsample analysis shows additional evidence for the incentive alignment hypothesis and little indication for the interest rebate hypothesis as driving mechanism behind the spread reduction in dual holdings.

II.3.2 Quasi experiment

In Table II.2 and Table II.3 we ran multivariate regressions to determine the effect of dual holdings on the loan spread. Although we used a broad set of variables connected to borrowing cost established by previous literature, there could be unobserved variables, which are correlated to both, the loan spread and the probability of a dual holding. In case these unobserved factors were positively related to the probability of an investment by a PE-affiliated CLO manager and negatively related to the loan spread, the dual holding coefficients would be biased downwards, thus overestimating the loan cost-reduction effect through dual holdings.

One possible source of endogeneity can be explained by signaling theory. The utilization of a company's capital structure to signal private information to potential creditors is a well-established concept in the literature on information asymmetry. Leland and Pyle (1977) show that entrepreneurs with informational advantage can signal a high quality to creditors by retaining a larger share of the company's equity. Milde and Riley (1988) indicate that the requested loan amount may also serve as a quality signal to borrowers. Tykvová (2017) demonstrates, that early stage venture capital investors can use the choice between late stage venture capital and venture lending as well as the offered share of equity and payment of interest to signal the quality of their company.

In our setting, it is possible that by investing on the debt side, asset management groups signal hidden loan characteristics they know about through their position as PE sponsor. While the other debt investors might understand that signal and react by lowering their spreads, this effect can't be captured by any control variable, as the transferred information is by definition not observable for anyone but the PE sponsor. The resulting negative *Dual Holding* coefficient would then be misinterpreted as an incentive alignment effect, while in reality it just captures private information that the dual holding asset management group reveals through its debt investment. The described signaling mechanism is just one of many possible examples for the presence of endogeneity in our model.

To mitigate this endogeneity problem, we use CLO manager takeover events as a quasi-experiment. During our observation period, several large PE firm running asset management

groups established or extended their debt business. In many cases, they did so by buying existing CLO managers as a whole or taking over a number of CLOs previously run by another manager. Examples include the acquisition of GSO Capital Partners by Blackstone in 2008, the takeover of Mizuho's debt management platform by 3i in 2011 or the acquisition of the European manager Avoca Capital by KKR in 2014. Once an asset management group with a PE firm acquires a CLO manager or takes over responsibilities for a CLO, some of the companies see a switch in their dual holding status. Since it is highly unlikely that these acquisition decisions are affected by unobservable factors at the individual company-CLO manager level, a CLO takeover creates exogenous variation in the dual holding variable. Hence, by utilizing M&A activities in the CLO market during our sample period, we are able to exploit variation in the dual holding status of a company-CLO manager pair that is arguably exogenous to unobservable factors affecting loan investment decisions. This way, we can identify the causal effect of dual holdings on borrowing cost.

The loan spreads themselves are fixed during the process of issuance. Thus, they don't change along with the dual holding status. However, syndicated loans are traded on the secondary market. The relationship between loan prices and yield to maturity (YTM) is inverse: If the loan price increases, the yield decreases and vice versa. Hence, higher loan prices reflect, ceteris paribus, lower implied credit risk and lower cost of borrowing for the company, as a newly issued loan competes with outstanding traded loans to the same company on the capital market.

To identify event loans, we take all CLOs, which were taken over by a PE firm between 2008 and 2015. Among these CLOs, we observe the portfolio holdings reported by CLO-i in the month before and after the manager change. All loan facilities of companies which have at least one PE sponsor, belonging to the same asset management group as the new CLO manager are potential event loans. However, the group may already hold loans from the company in its debt portfolio through CLOs managed by the group prior to the takeover event. In these cases, the CLO takeover doesn't establish a new dual holding relationship. We separately analyze the price development for all loans with new and pre-existing dual holdings during a CLO takeover. If the existence of dual holding reduces agency conflicts, we expect higher loan prices after a newly

established affiliation between an equity owning PE firm and a debt holding CLO manager of the company.

We use IHS Markit quotes to observe the secondary market prices of the event loans. Markit offers bid- and ask quotes for a wide range of syndicated loans on a daily basis. To find the corresponding LXID[18] we match our dataset with Markit using variables from CLO-i and DealScan. We use the trade date, unified company and loan designations as well as the loan type, currency and maturity to identify the correct LXID for each CLO-i portfolio holding. We take quotes from the last day of the penultimate month before the CLO manager change until the last day of the takeover month. This way, we observe the loan prices for a time period of two months around the event. In addition, we use the last day of the fourth month after the takeover month as end date, to observe the price development in the first half year around the event as well.

To adjust the price change for the market development, we use the average mid quotes[19] of three matched control loans as benchmark for the mid quote development of each treatment loan. As stated above, it is highly unlikely that an asset management group bases its CLO (manager) takeover decision on characteristics related to a single portfolio loan, even if the issuing company is sponsored by the group's PE firm. However, there could be unknown CLO characteristics correlated to both, the probability of a takeover and the expected returns of the portfolio loans at a specific point in time. For that reason, we use the portfolio of the CLO taken over that includes the treatment facility as the matching universe for the potential control loans in our first setting. In case several CLOs holding the same treatment facility are taken over simultaneously by an asset management group, loans from each of their portfolios are potential controls.

Before an asset management group takes the choice to acquire a specific CLO (manager) it has to decide for an expansion in the debt business in the first place. It is possible that this decision is related to unobserved characteristics in the portfolio of the group's PE firm. If these factors are also related to the returns of facilities issued by the PE firm's portfolio

[18]The LoanX ID (LXID) is a unique identifier for syndicated loans provided by IHS Markit.
[19]We define the mid quote as (bid quote+ask quote)/2.

companies, these loans could systematically over- or underperform during the times of affiliated CLO takeovers. Therefore, in a second approach we match the treatment loans to outstanding control loans, issued by companies that are also sponsored by the PE firm of the group taking over the CLO.

For each of the two matching universes we narrow down the potential controls by selecting the loans with available Markit quotes around the time of the takeover event as well as an identical currency and rating letter as the treatment facility. Since we treat "No Rating" like a separate rating letter, unrated treatment loans can only be matched to unrated control loans. For the CLO portfolio based matching, we also limit the maturity difference between the treatment and control loans to 365 calendar days. In the PE sponsor based matching, we don't exclude potential control loans based on maturity differences, as this would reduce the number of possible matches to heavily. The reason for that is the way lower number of companies in the equity portfolio of a PE firm compared to the portfolio holdings of a CLO.

If the number of remaining controls for a specific treatment loans is three or lower, we use all of them as control loans. For cases with four or more possible control loans, we take the three facilities with the smallest mid quote difference from the treatment loan before the takeover as controls. In occasional instances of two loans being tied for third place in terms of the closest quote difference, we include both of them, ending up with four control loans for the observation. We use the mid quotes for matching, since the current price level is closely related to the upside potential as all loans are eventually repaid at par if they aren't defaulted by the maturity date. Thus, loan facilities with a current price of 80 and 100 will have a cumulative price return of 25% and 0% over their remaining outstanding time, provided both companies fully repay the principle amount at the day of maturity.

Table II.A.2 in the appendix shows the summary statistics for the loans in our return analysis, separated by the universe of matched control loans, as well as the pre-existence of a dual holding investor in the treatment loans. The number of treatment loans is slightly lower in the samples with control loans sponsored by the same PE firm. This is because more unmatched event loans drop out of the analysis due to the unavailability of a suitable control as a result of the lower number of portfolio companies in PE firms compared with CLO holdings. For the

same reason each treatment loan in the CLO matched panel has a higher number of control loans compared to the PE firm one.

In the CLO matched panel neither the price (i.e. the Markit mid quote) before the takeover event, nor the rating or maturity shows statistically significant differences between the treatment and control loans. Among the PE firm matched loans, the mean maturity is somewhat higher (4.76 vs. 3.99) and the average pre-event price lower (91.66 vs. 94.25) for the treatment compared to the control facilities. These differences, which only show up in the subpanel with newly emerging dual holdings, are likely a result of looser matching conditions. Unlike in the CLO holding universe, for the panel with treatment and control companies sponsored by the same PE firm, we don't require a maximum maturity difference of 365 days for matching. Moreover, as the number of potential control loans exceeds the value of three less often the pre-event price is less frequently used to select the control facilities.

Besides the variables we use for matching, Table II.A.2 also displays the summary statistics for the number of quoting dealers at the starting day of our return calculation. This can be interpreted as both, a measurement of the loan liquidity and the accuracy of the quoted prices. For all four subpanels the mean number of quoting dealers is higher in the sample of treatments than control loans with differences ranging from 0.17 to 2.45 dealers.

We refer to the difference between the return of the treatment loan and the average return of its control loans as the *Control-adjusted Return*. Table II.4 shows the means of the *Control-adjusted Return* calculation for our event loans. The upper sample comprises all loans where the manager takeover established a new dual holding relationship. The lower sample contains the loans with a pre-existing dual holding relationship via other CLOs belonging to the same group as (one of) the company's sponsoring PE firm(s). Columns (1) and (2) present the average *Control-adjusted Returns* in the two months around the takeover while (3) and (4) additionally include the following four months. The uneven columns show the results for the sample with control loans of the same CLO portfolio as the treatment loans. In the even columns, the return adjustment is based on matched control loans issued by companies that are also sponsored by the PE firm of the asset management group taking over the CLO that holds the treatment loan.

The table shows economically and statistically significant positive effects on secondary mar-

Table II.4: This table presents the *Control-adjusted Returns* of loans in the quasi-experiment. Columns (1) and (2) show the mean difference between the Markit mid quote change of the treatment loans and the three matched control loans from one month before to one month after the CLO-manager takeover. Columns (3) and (4) capture the mean difference between the Markit mid quote change of the treatment loans and the three matched control loans from one month before to five months after the CLO-manager takeover. The control loans in uneven columns are part of the same CLO portfolio as their matched treatment loan. In even columns, the controls consist of outstanding facilities issued by companies with the same sponsoring PE firm (which belongs to the group taking over the CLO) as the borrowing company in the corresponding treatment loan. New DH presents the *Control-adjusted Returns* for events where the manager takeover created new dual holdings. Existing DH shows the *Control-adjusted Returns* for loans with pre-existing dual holdings via loans of the same company in portfolios of other affiliated CLOs.

Time frame	2 months		6 months	
Matched holdings	CLO	PE firm	CLO	PE firm
	(1)	(2)	(3)	(4)
New DH	1.45%	0.88%	2.59%	2.00%
	(0.008)	(0.063)	(0.017)	(0.105)
N	52	50	44	41
Existing DH	0.06%	0.44%	0.21%	-0.02%
	(0.893)	(0.102)	(0.665)	(0.954)
N	83	80	66	61

ket prices for loans in the two months around the emergence of a dual holding investor. For the sample with control loans of the same CLO portfolio, the mean *Control-adjusted Returns* yields at 1.45%. Using the returns of facilities issued by portfolio companies of the same PE firm as benchmark, the excess return decreases by approximately 40% to 0.88% but still remains economically meaningful with regard to the usually relatively small price movements in the secondary loan market.

Adding the four subsequent months to the observation period, we are respectively losing 15% and 18% of the events in our two samples due to the unavailability of Markit quotes at the end of the time frame. For the remaining loans, the mean *Control-adjusted Returns* approximately doubles in comparison with the two-month period. However, although increasing to 2% the mean excess return loses its statistical significance for the PE firm matched sample when we increase the time horizon. This is mainly the result of two factors: A higher variance of longer-term loan returns and a sample size that becomes increasingly limited with the additional loss of nine treatment loans through missing Markit quotes. Despite being influenced by the same factors, in the sample with controls of the same CLO portfolio, the mean *Control-adjusted*

Returns return remains statistically significantly different from zero and gets economically very large with 2.59%.

Besides the sample with new emerging dual holdings, we also observe the price development of loans to companies sponsored by PE firms of the same group as the new CLO manager but have a pre-existing dual holding status. In this sample, we can't observe any significant excess return over the control loans regardless of the observation period.

Despite the limited sample size, the results of this quasi-experiment strongly support our hypothesis of decreasing credit risk in companies with debt and equity holders belonging to the same asset management group. As all other loan terms remain equal, the increasing secondary market price goes along with a lower YTM and thus a lower risk premium for the facility. It is highly unlikely that the takeover decision of CLOs or even of a whole CLO manager is motivated by a single holding in its loan portfolio. Thus, we expect no relation between the new establishment of a dual holding status and any factor on the level of the event loan or borrowing company, which could also be correlated with the risk premium. As we calculate the *Control-adjusted Returns* against benchmark loans during the same period, an omitted variable bias through unobserved factors in the time dimension is also implausible. This mitigates endogeneity concerns and thus strengthens the interpretation that the increasing prices (decreasing yields) are caused by the emergence of a dual holding. The absence of significantly positive *Control-adjusted Returns* in loans with previously existing dual holdings suggests that an additional loan-investment by a PE sponsor-affiliated CLO manager doesn't lead to a further loan cost reduction when the dual holding status is already established.

II.3.3 Dual Holdings in LBOs

Previous literature has established close connections between CLOs and the LBO business of PE firms. Benmelech et al. (2012) show that LBO-financing loans are more likely to involve CLO lenders than other syndicated loans. Therefore, credit conditions for LBO loans are significantly related to CLO activity. Axelson et al. (2013) observe that periods during which CLOs hold a higher fraction of LBO loans are associated with increased buyout leverage and thus looser lending standards. Shivdasani and Wang (2011) specifically focus on the role of CLOs in the

LBO boom of 2004-2007 and discover a close relation between growing CLO and LBO volume. Moreover, they find high CLO underwriting activity of a bank to be associated with more LBO lending as well as lower spreads and looser covenants in LBO loans, implying a direct connection between these two business segments. After the turmoil in the LBO market during the global financial crisis, banks increasingly pre-syndicated LBO loans to CLOs before closing the deal in order to reduce their syndication risk (Fahlenbrach et al., 2023). This indicates an enduring relevance of CLOs for the funding of LBO deals lasting beyond the global financial crisis.

Considering the special relation between CLOs and LBOs we take a closer look at the economic impact of dual holdings on LBO transactions. Therefore, we first calculate the spread reduction effect by replicating the spread regression from Table II.2 for the subsample of facilities where DealScan assigned "LBO" or "SBO" as primary loan purpose. As the summary statistics in Table II.1 shows, this is the case for 38% of all facilities in our sample. In comparison to the original regression, we omit the *LBO/SBO* dummy from the vector of control variables, as it is one for all remaining loan facilities by design.

Table II.A.3 in the appendix shows the estimators from this regression. With the exception of the insignificant *Secured* dummy all coefficients have the same sign as in the total sample, suggesting that similar factors are driving the spreads of LBO-financing facilities and other leveraged loans. However, the, depending on the model, 5-18 bp lower estimators for the *Dual Holding* coefficient indicate a stronger magnitude of the spread reduction effect in LBO loans.

After having estimated the spread reduction through dual holdings in LBO loans, we want to quantify the economic impact in terms of incremental equity returns (IRR) of LBO transactions. In line with Ivashina and Kovner (2011), we assume that the typical LBO capital structure consists of 30% equity and 44% leveraged loans. We further assume that a PE firm's typical exit horizon is four years and that the LIBOR is flat at 0.5%.[20] Based on the *Effective Spread* model with relationship controls, the takeover company pays, ceteris paribus, 50 bp less credit spread if it has an equity-owning creditor compared to a peer company without a dual holder. This results in annual interest savings of approximately 2.62 million USD on an affiliated facility of mean size (524.76 million USD, from Table II.1). The present value of these interest savings,

[20] Over the time period between 2009 and 2015 the three month LIBOR had a mean value of 0.37%.

received over four years (the PE firms' exit horizon) and discounted at 4.25% (LIBOR of 0.5% + median *AISD* of 375 bp for affiliated facilities in Table II.1), is 9.47 million USD. This yields an incremental additional cumulative return of 265 bp, given a 30% (or 357.79 million USD) equity share in the LBO's initial capital structure and a corresponding 73 bp higher IRR.

We want to point out that the informative value of the results on the economic effect is limited. On the one hand, we likely underestimate the economic impact of dual holdings on borrowing conditions and LBO equity returns. While we look only at price terms (OID and *AISD*), the incentive alignment might also have a favorable impact on non-price terms like maturity and financial covenants. On the other hand, PE firms reduce the opportunity to exploit their position as agents. The initially higher agency cost represents anticipated risk shifting activity. We expect equity holders to be partly compensated for the additional funding cost by higher returns through wealth-transfer from the debt holders. How much of the additional equity return from cost-savings is lost through lower expected cash flows to the owner as result of a reduced risk shifting exploitation could be part of future research.

Moreover, we only calculate the effect for the PE firms. At the group level, the return is also affected by the profit of the debt holding CLO manager. In principle, lower spreads would reduce this return channel. However, in this section we provided evidence that the spread reduction is related to shareholder-creditor agency conflict mitigation, which reduces credit risk for the company's debt holders. It is impossible for us to evaluate whether the credit spreads also decrease on a risk-adjusted basis. Nevertheless, for facilities with subsequent secondary market sales, the additional results in section II.4 contradict the hypothesis of overall lower returns for the CLO managers through dual holdings.

II.4 Additional results

Besides the incentive alignment effect of dual holdings, PE firms' superior access to information as majority owners of their portfolio companies can have positive spillover effects to affiliated CLO managers. That is, without effective "chinese walls", communication between the CLO manager and the PE firm of the same asset management group may confer private information

from the equity to the debt management part of the group. Eventually, CLO managers may exploit this information when trading dual holding facilities in the secondary loan market. In this case, we would expect the trades in dual holding facilities to be a source of outperformance for PE-affiliated CLO-managers.[21]

However, if affiliated CLO managers are informed traders ("insiders"), who are the "outsiders", the ones that trade at an informational disadvantage? Indeed, since trading in the secondary market for a given facility is typically organized by the facilities' lead arranger acting as dealer, informational advantages on the part of affiliated CLO managers are not obvious. Moreover, it is generally believed that the number of uninformed liquidity (or "noise") traders is limited in the institutional syndicated loan market, compared to equity markets (Allen et al., 2012). Hence, consistent with the idea of secondary loan market trading being informationally efficient, Addoum and Murfin (2020) find that the public prices of traded facilities predict cross-sectional variation in future stock returns. On the other hand, evidence of significant performance persistence has been discovered for CLO managers (Liebscher and Mählmann, 2017) and general partners in private debt funds (Böni and Manigart, 2022), a finding in line with exploitable loan market inefficiencies. At the end, it remains an empirical question whether CLO managers benefit from informational advantages relative to their counterparty.

To investigate the potential effect of an information advantage by dual holding CLO managers, we analyze realized returns of *dual holding* and *non-dual holding* round-trip (RT) trades. Transactions are dual-holding trades when both, the trading CLO manager and the PE firm owning the company underlying the trade belong to the same asset management group. Because spreads (*AISD*) in DealScan are only measured at origination and are therefore time-invariant, we rely on pure "price returns" to capture the information acquired and "priced" by secondary market traders. We compute returns according to the FIFO principle, i.e., we assume that the first sale of a loan or bond belongs to its first purchase.[22] Importantly, all prices are *realized*,

[21] Anecdotal evidence in line with the information spillover effects can be found in an Wall Street Journal interview ((see Tan, 2014), Brian Sheth, one of the two founders of Vista Equity Partners, was asked the question:"*You've got a debt fund, Vista Credit Opportunities. Does it invest alongside your equity fund?*" He replied: "*We've made 35 investments across 21 companies. Of those [investments], only six are not affiliated with Vista and three are Vista minority investments. We've got unique insights on how these companies are managed and how credit should be priced.*"

[22] The results are unchanged if we follow the LIFO approach instead.

that is, actual prices paid or received by the CLO. Hence, we do not rely on quoted midpoints to construct *paper* returns. We restrict our analysis to trades in facilities from companies owned by PE firms to address the concern that sponsored companies might be fundamentally different from non-sponsored ones (Ivashina and Kovner, 2011).

Our setting offers several important advantages compared to studies trying to determine the returns to informed trading in equity markets. For equity markets, data limitations make it generally impossible to infer true holding periods which in turn prevent researchers from computing actual returns to insider trading (Jeng et al., 2003). Instead, researchers have to rely on proxy returns. Even worse, some studies (e.g., Ivashina and Sun, 2011b) must employ SEC 13(f) institutional investor filings and deduce informed trading from quarterly holding changes. However, nothing is known about the exact trading behavior of investors within a quarter. Moreover, equity studies often utilize close-to-close (*paper*) returns computed from daily closing midpoints, not from actual prices paid or received by informed traders. Our return calculation, in contrast, is not subject to any of these limitations. Hence, we believe that our analysis of RT returns provides a valid proxy for what potential insiders (dual holding CLO managers) can earn in the secondary loan market.

Par building trades. Before we turn to our return comparison exercise, we highlight an important institutional feature that likely influences the trading behavior of CLOs. As a result of their compensation structure, CLO managers are motivated to sell appreciating facilities ("winners") early and depreciating facilities ("losers") only at times when liquidity is needed. This behavior is commonly referred to as "par building" and helps managers to fulfill CLO covenants.[23] Consequently, we would expect to see higher returns for "younger" trades and weaker results for trades with a longer time period between purchase and sale. Table II.5 provides descriptive information for trades of dual holding (in Panel A) and non-dual holding (in Panel B) trades. The table shows separate return statistics for winning and losing trades and also the corresponding holding period statistics. Looking at dual holding trades, the mean winning return is 3.6% and the mean losing trade returns -2.7% (medians are 1.5% and -0.8%,

[23]In particular, by selling losers CLO managers likely reduce the nominal value of their portfolio. This, in turn, lowers their compensation and exposes them to the risk of violating collateral and interest rate coverage tests (Antczak et al., 2009, p. 94).

respectively). As expected, there are large differences in holding periods. Winners are on average realized after 325 calendar days whereas losers are hold for additional 184 days (or 56.6% longer). A similar picture emerges for non-dual holding trades in Panel B. Hence, the par building effect generates a negative relation between holding periods and returns. Note that the par building effect can be considered the rational twin of the likely irrational disposition effect found among individual investors in equity markets (Odean, 1998).

Table II.5: This table shows summary statistics for dual holding (Panel A) and non-dual holding trades (Panel B). The returns are computed according to the FIFO principle, i.e., first sale of a loan is assumed to belong to the first purchase of this loan. Holding Time measures the difference in calendar days between the purchase and the sale date.

	N	mean	sd	p5	p10	p25	p50	p75	p90	p95
Panel A: Dual Holding Trades										
– **Winners**										
Returns	554	3.6%	4.9%	0.3%	0.3%	0.6%	1.5%	4.1%	12.0%	15.6%
Holding Time	554	325	353	3	13	48	241	455	818	1,025
– **Losers**										
Returns	472	-2.7%	6.4%	-8.6%	-5.7%	-2.3%	-0.8%	-0.6%	-0.3%	-0.1%
Holding Time	472	509	432	69	136	174	344	867	1,209	1,221
Panel B: Non-Dual Holding Trades										
– **Winners**										
Returns	28,560	4.3%	12.6%	0.2%	0.3%	0.6%	1.4%	4.1%	10.2%	16.2%
Holding Time	28,560	292	325	5	12	53	177	412	749	991
– **Losers**										
Returns	14,942	-6.5%	11.6%	-29.6%	-19.3%	-6.4%	-2.0%	-0.6%	-0.3%	-0.1%
Holding Time	14,942	411	372	35	64	143	293	553	951	1,245

Univariate tests. We now look at the association between the return and the dual holding status of a trade. We start with univariate comparisons. To control for the par building effect, we sort all RT trades into quintiles based on the time between purchase and sale of the facility. Furthermore, to account for overall loan market conditions, we subtract the contemporaneous price return of the Leveraged Loan Index from the raw trade return.[24] We call these returns *Excess Returns*. Table II.6 presents the results, both for simple and annualized *Excess Returns*. In line with the par building effect, price returns decrease significantly with the time between the purchase and sales date (i.e., from Q1 to Q5). This holds especially true for the larger sample of non-dual holding trades. More interestingly, looking at within-quintile differences

[24]We use the Morningstar LSTA US Leveraged Loan Index for dollar trades and its European counterpart for trades in other denominations. Both indexes are designed to capture the overall price development in the respective institutional segment of the leveraged loan market. Hence, they should provide appropriate benchmarks.

reveals a consistent outperformance of dual holding over non-dual holding trades. Mean *Excess Returns* in the dual holding subsample are between 30 and 310 bp larger than for the group of non-dual holding trades. This translates into 40 to 330 bp on an annualized basis. While these univariate tests provide a somewhat volatile estimate of the value of private information, the overall picture strongly supports the information advantage hypothesis.

Table II.6: This table shows two-sided t-tests for differences in *Excess Returns* – allowing for unequal variances and holding the trade duration quintile (Q1 to Q5) constant. Returns are computed according to the FIFO principle, i.e., the sale price of an instrument is matched to the price of its first purchase. All variables are winsorized at the 1% and 99% percentile. Benchmark for the *Excess Returns* is the Morningstar LSTA US Leveraged Loan Index for trades in USD, respectively the Morningstar European Leveraged Loan Index for trades in Euro. The p-values for the two-sided t-tests are reported in parentheses and the number of observations within each group stands below each group-level mean.

	Excess Return			Annualized Excess Return		
	Non-Dual Holding	Dual Holding	Difference	Non-Dual Holding	Dual Holding	Difference
Q1	0.8%	1.1%	0.3%	30.3%	33.6%	3.3%
	9,190	193	(0.022)	9,190	193	(0.366)
Q2	0.3%	1.4%	1.1%	2.6%	5.0%	2.4%
	9,165	148	(0.000)	9,165	148	(0.004)
Q3	-0.3%	1.4%	1.7%	0.1%	2.4%	2.3%
	8,966	246	(0.000)	8,966	246	(0.000)
Q4	-2.5%	0.6%	3.1%	-2.3%	0.4%	2.7%
	9,103	225	(0.000)	9,103	225	(0.000)
Q5	-5.4%	-4.5%	0.8%	-2.4%	-2.0%	0.4%
	8,997	265	(0.176)	8,997	265	(0.244)

Multivariate tests. Table II.7 presents results from multivariate tests, i.e., OLS regressions with the annualized *Excess Return* as the dependent and the *Dual Holding* dummy[25] as independent variable. The positive dual holding effect holds when we add further controls for the trading volume, a bond dummy, a dollar dummy as well as rating letter fixed effects (see Column 1). In this specification dual holding trades show a 2.9% higher annualized *Excess Return*. The regressions in the first three columns of Table II.7 are run on the full set of RT trades in sponsored facilities from all CLO managers (PE-affiliated or not) for which we observe trading data. However, independent (non-PE-affiliated) managers might be fundamentally different from their affiliated peers, for example in terms of trading skill or style. This might bias the *Dual Holding* coefficient because all trade return observations from unaffiliated managers are

[25]The definition of the *Dual Holding* dummy diverges slightly from the one we used above. In the spread analysis, the dummy measured the dual holding status on the company level. Here we measure the dual holding status on the trade level, meaning that the specific CLO manager participating in the observed trade must be affiliated to the company's PE sponsor and thus cause the dual holding.

assigned the value zero for *Dual Holding*. To address this concern, we replicate the baseline regression from Column (1) for the subsample of trades executed by PE-affiliated CLO managers. The results, shown in Column (4), remain unchanged.

Table II.7: This table presents results from OLS regressions of annualized *Excess Returns* on the *Dual Holding* dummy and controls. The dependent variable is winsorized at the 1% and 99% percentile. The constant is not reported. Columns (1) through (3) show results for a sample of PE-affiliated and unaffiliated managers where Columns (3) to (6) are only for a subsample of trades from managers affiliated to a PE firm. In Columns (7) through (9) the sample is confined to observations from affiliated companies. Standard errors are double-clustered (Cameron et al., 2011) along sale date quarters and companies with the corresponding p-values reported in parentheses.

	Dependent variable: Annualized Excess Return in %								
	Full Sample			Only Affiliated Managers			Only Affiliated Companies		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dual Holding	2.867	2.608	3.401	2.826	2.185	3.294	4.060	2.335	4.186
	(0.044)	(0.004)	(0.056)	(0.042)	(0.031)	(0.028)	(0.003)	(0.017)	(0.025)
Log(Trade Volume)	0.314	0.105	0.483	0.163	-0.035	0.237	0.815	0.411	0.961
	(0.166)	(0.506)	(0.064)	(0.577)	(0.884)	(0.366)	(0.023)	(0.231)	(0.008)
Log(Holding Time)	-9.682	-9.811	-9.668	-9.831	-9.842	-9.784	-8.620	-8.848	-8.642
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bond Dummy	5.268	6.977	5.189	5.785	6.837	6.079	8.770	12.730	8.957
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.010)	(0.014)
USD Dummy	1.719	-0.092	2.833	0.587	0.570	2.093	3.371	0.705	5.894
	(0.138)	(0.962)	(0.051)	(0.628)	(0.799)	(0.131)	(0.068)	(0.711)	(0.034)
Company FE	No	Yes	No	No	Yes	No	No	Yes	No
Manager FE	No	No	Yes	No	No	Yes	No	No	Yes
Rating Letter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	44,484	44,484	44,484	22,107	22,107	22,107	10,299	10,299	10,299
Adj. R^2	0.293	0.408	0.311	0.312	0.469	0.318	0.293	0.350	0.326

Similarly, the facilities from some companies are never traded by affiliated CLOs. If these "unaffiliated" companies differ in unobservable ways from their affiliated peers, and this heterogeneity is correlated with trade returns, the *Dual Holding* coefficient will still be biased. Accordingly, we verify our results in the last three columns of the table by restricting the sample to trades in facilities from affiliated companies. The *Dual Holding* coefficient in the baseline regression (Column 7) becomes highly statistically significant, and its magnitude is now even larger, implying an outperformance of 4.1% annually. Therefore, the findings are not specific to trades by the group of PE-affiliated CLO managers or to trades in affiliated facilities in general, but only to dual holding trades.

The outperformance of dual holding trades is consistent with the spillover of non-public information from the PE firms to CLO managers belonging to the same group. However, access to private information may not be the only possible explanation for the observable outperformance. To further rule out alternative explanations of this result, we start by addressing the concern that there might be something special about the sponsored companies in which dual holding trades take place. If this is true, then all trades in a given company's facilities should perform equally well, i.e., outperformance should not be characteristic of trades by CLO managers affiliated with the company's PE sponsor. We turn to demanding specifications and add company fixed effects in Columns (2), (5) and (8). Hence, the *Dual Holding* coefficient is now identified by affiliated and unaffiliated trades in facilities from the *same* issuing company. The estimated coefficients are reduced but remain meaningful in economic terms, implying outperformance of dual holding trades by 2.2-2.6%, and always statistically significant at least at the 5% level. These findings suggest that dual holding CLO managers beat their peers in terms of timing trades in affiliated companies.

As argued above, it could be that there is something unique about PE-affiliated CLO managers. For example, they follow superior investment styles or are simply more skilled as a result of manager self-selection when talented managers view PE-affiliated CLO managers as presenting more prestigious career paths. Taking into account this alternative we add CLO manager fixed effects in Columns (3), (6) and (9). In this way, we compare the performance of dual holding and non-dual holding trades across the *same* manager. The intuition is that if there is something special about the manager, then there is no reason why this "special" skill should only apply to dual holding trades. For the within-manager regressions, average outperformance of dual holding trades increases to 3.3-4.2%. This implies that private information acquired through PE-affiliations is not only valuable for market timing, but also helps to evaluate which facilities to select for trading.

Overall, the fixed effects regressions verify that outperformance is CLO manager-specific (dual holding trades outperform non-dual holding trades within the same company) *and* company-specific (dual holding trades outperform non-dual holding trades within the same CLO manager). Hence, outperformance is not representative of managers' or companys' overall charac-

teristics.

We can use the findings in Table II.7 to estimate the total benefits of dual holding trades for CLOs. In particular, assuming an average within-manager outperformance of dual holding trades of 4.2% (from Column 9), and setting the size of all dual holding RT trades to 1,114 million USD (grand total across years), the monetary benefit of insider trading amounts to 46.8 million USD (on an annualized basis). To better understand the economic value of this number, several points are noteworthy. One is that we look at excess returns, over and above what can be earned by simply investing in the market. Furthermore, the returns are *price* returns of debt instruments which do not include interest income and naturally provide only limited upside potential. And finally, while the number of dual holding trades is relatively low (annual average of 152 over the period 2009-2015), the growth rate is high, at 140% a year. Hence, this type of informed trading in the loan market might become an even bigger issue in the future.

What are the likely sources of CLO managers' informational advantages in dual holding trades? One obvious possibility is that they are better able at timing rating changes due to tips received from their affiliated PE firm regarding upcoming rating events. Hence, they buy before unanticipated rating upgrades and/or sell in advance of downgrades.[26] This strategy, however, is unlikely to be profitable here due to the institutional structure of loan trading. Investors trade with lead arrangers acting as dealers in the secondary market, and lead arrangers should be equally well informed about upcoming major events like rating changes. Nevertheless, to test this "rating tipping" mechanism, we control for the change in facility ratings (transformed into one-year implied probabilities of default)[27] over the course of a trade. Results for regressions similar to the ones in Table II.7 are displayed in the appendix (Table II.A.4). Unsurprisingly, we find that rating upgrades are associated with higher trade returns: a one standard deviation (8.26%) decrease in the rating-implied PD over the life of a trade raises the return by 1.43%. More importantly, the coefficients for *Dual Holding* are qualitatively similar to those in Table II.7, inconsistent with a rating tipping story.

Cross-sectional tests. We now examine cross-sectional predictions of the information

[26] Irvine et al. (2007) find evidence consistent with tipping behavior before the release of stock analysts' initial buy recommendations.

[27] see appendix II.5 for more information on the construction of the rating implied one year PD variable.

spillover effect. We rely on the notion that informed investors will concentrate their trades on information-sensitive instruments, because these are the ones from which they can hope to earn informational rents. Hence, if privileged access to private information is indeed the driver behind the results in Table II.7, we would expect the marginal effect of dual holding trades to vary with a facilities' information-sensitivity and, more broadly, with the value of information. To test this hypothesis, we run regressions where we interact *Dual Holding* with proxies for a facility's information sensitivity.

Our first proxy is the rating-implied one-year *PD*. Han and Zhou (2014) provide evidence indicating that bonds become more information-sensitive when the issuer is closer to default. If a company's credit quality is low but a CLO manager has private knowledge about upcoming positive fundamentals from an affiliated PE firm sponsoring the company, buying its loan facilities before the positive news become public results in excess returns. We thus expect the sign on the interaction between *Dual holding* and *PD* to be positive.

Similarly, the return on private information may be stronger for facilities that are priced at a discount. Since lead arrangers (informed relationship banks) act as dealers and post daily bid and ask quotes, secondary market prices (or midquotes) should be more timely measures of credit quality than infrequently updated ratings (Addoum and Murfin, 2020). To account for time-series variation in market liquidity and other market-wide characteristics, we define an adjusted "price discount" dummy that is one if the trade price is lower than the median price of all traded instruments (loans and bonds) in the same quarter, and zero otherwise. We conjecture that the interaction term between this variable (*Distress*) and *Dual Holding* is positive.

As our final proxy, we take the fraction of managers in our sample that hold the instrument in question in the month prior to the start of the trade. We argue that if more managers invest in a given facility, private information about the borrower is more widespread. This might be because lenders benefit from information rights through their participation as syndicate members (e.g., Ivashina and Sun, 2011a; Bushman et al., 2010). In contrast, if the number of managers holding a facility is low, the information asymmetry between a CLO manager affiliated to a PE sponsor of the issuing company and the rest of the market should be high. This suggests that the value of private information is decreasing in the number of managers

holding a facility, implying a negative coefficient for the interaction term between *Dual Holding* and *# Managers*.

Table II.8: This table displays coefficient estimates from a regression of *Annualized Excess Returns* on the *Dual Holding* dummy, an information sensitivity proxy and the interaction term between these two. PD is the one-year rating-implied probability of default averaged over Moody's and S&P's rating. Distress is a dummy equal to one if the price of the loan or bond is below the median for all trades in the same quarter. # Man (short for # Manager) is the number of managers that hold the loan or bond in the month before the trade. Other control variables are the same as in Table II.7. The dependent variable is winsorized at the 1% and 99% percentile. Standard errors are double-clustered (Cameron et al., 2011) along sale date quarters and borrower names with the corresponding p-values reported in parentheses.

	Dependent variable: Annualized Excess Return								
	Full Sample			Only Affiliated Managers			Only Affiliated Borrowers		
	PD	Distress	# Man	PD	Distress	# Man	PD	Distress	# Man
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dual Holding	-5.233	-1.070	2.980	-3.536	-0.773	3.072	-5.846	-0.686	4.375
	(0.184)	(0.459)	(0.128)	(0.383)	(0.540)	(0.112)	(0.100)	(0.610)	(0.011)
Inf. Sens. Proxy	-0.385	1.336	-3.731	-0.149	1.052	-2.854	-0.597	0.615	-2.064
	(0.001)	(0.159)	(0.015)	(0.356)	(0.287)	(0.058)	(0.000)	(0.556)	(0.187)
Dual Holding*Inf. Sens. Proxy	1.245	5.095	-1.300	0.994	4.657	-1.801	1.474	6.146	-3.229
	(0.000)	(0.011)	(0.738)	(0.000)	(0.007)	(0.658)	(0.000)	(0.006)	(0.335)
Rating Letter FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Further Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	44,484	44,484	44,484	22,107	22,107	22,107	10,299	10,299	10,299
Adj. R^2	0.300	0.293	0.294	0.312	0.312	0.312	0.319	0.294	0.293

Turning to the results shown in Table II.8, all the interaction terms have the predicted sign. The coefficients for the *PD* proxy in Column (1) indicate that dual holding trades do not outperform non-dual holding trades for BB- rated facilities (one-year PD of 3.8%), but the outperformance becomes a significant 4.9% ($8.1 * 1.245 - 5.233$) a year for facilities rated one full letter below at B-, representing a one-year PD of 8.1%. Moreover, Column 2 suggests that the outperformance of dual holding trades is concentrated in *Distress* instruments (at 4% a year) and is not significant for instruments without a noticeable price discount as measured relative to other instruments of the same type (loan or bond) and quarter. Although showing the hypothesized sign, the interaction term with *# Managers* is insignificant. All the results remain qualitatively similar when we restrict the sample to trades executed by affiliated managers (Columns 4 to 6) or in affiliated borrowers (Columns 7 to 9). In sum, the cross-sectional tests strongly support information advantages as driving factor behind the outperformance in dual

holding trades.

II.5 Conclusion

This paper studies implications of PE firms' expansion into the CLO market starting in the late 2000s. Due to large overlaps among the companies in the PE and leveraged loan segment, asset managerment groups owning PE firms and CLO managers often become equity and debt holders in the same company. These dual holdings can mitigate the conflict of interest between debt and equity holders and thus decrease the cost of borrowing for the company.

In our regression analysis, we find loan spreads to be 32 bp lower in companies that exhibit dual holdings. This result is in the upper range of estimates for the effect of non-commercial banks holding debt and equity of public companies discovered by Jiang et al. (2010) but below the effect of dual holdings generated by private debt funds through middle-market loans determined by Buchner et al. (2022). Subsample analyses strengthen the incentive alignment hypothesis as driving factor behind the spread reduction. A quasi-experimental setting using CLO manager takeovers mitigates endogeneity concerns.

As lower credit spreads lead to, ceteris paribus, higher equity returns, intentional borrowing form affiliated debt investors may be a way for equity holders to increase their returns. Yet, only some PE firm running asset managerment groups use this type of financing to fund their deals. The factors influencing the decision for or against dual holding structures in PE portfolio companies could be an interesting topic for future research.

Finally, we find that CLO managers generate excess returns from dual holding compared to non-dual holding trades. The fact that excess returns of dual holding trades increase with a higher level of information asymmetry gives evidence for information spillover from PE firms to CLO managers belonging to the same group. Controlling for rating changes suggests that the information advantage is unrelated to upcoming rating events for the facilities underlying the dual holding trades.

II. References

Addoum, J. M. and J. R. Murfin (2020). Equity price discovery with informed private debt. *The Review of Financial Studies 33*(8), 3766–3803.

Allen, L., A. A. Gottesman, and L. Peng (2012). The impact of joint participation on liquidity in equity and syndicated bank loan markets. *Journal of Financial Intermediation 21*(1), 50–78.

Antczak, S. J., D. J. Lucas, and F. J. Fabozzi (2009). *Leveraged finance: Concepts, methods, and trading of high-yield bonds, loans, and derivatives*. Hoboken, N.J.: John Wiley & Sons.

Antón, M. and L. X. Lin (2020). The mutual friend: Dual holder monitoring and firm investment efficiency. *The Review of Corporate Finance Studies 9*(1), 81–115.

Axelson, U., T. Jenkinson, P. Strömberg, and M. S. Weisbach (2013). Borrow cheap, buy high? The determinants of leverage and pricing in buyouts. *The Journal of Finance 68*(6), 2223–2267.

Barnea, A., R. A. Haugen, and L. W. Senbet (1980). A rationale for debt maturity structure and call provisions in the agency theoretic framework. *The Journal of Finance 35*(5), 1223–1234.

Barnett-Hart, A. K. (2009). The story of the CDO market meltdown: An empirical analysis: Bachelor thesis.

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

Berg, T., A. Saunders, and S. Steffen (2016). The total cost of corporate borrowing in the loan market: Don't ignore the fees. *The Journal of Finance 71*(3), 1357–1392.

Berg, T., A. Saunders, S. Steffen, and D. Streitz (2017). Mind the gap: The difference between US and European loan rates. *The Review of Financial Studies 30*(3), 948–987.

Bharath, S. T., S. Dahiya, A. Saunders, and A. Srinivasan (2011). Lending relationships and loan contract terms. *The Review of Financial Studies 24*(4), 1141–1203.

Black, F. and M. Scholes (1973). The pricing of options and corporate liabilities. *Journal of political economy 81*(3), 637–654.

Block, J., Y. S. Jang, S. N. Kaplan, and A. Schulze (2023). A survey of private debt funds. *NBER working paper 30868*.

Bodnaruk, A., M. Massa, and A. Simonov (2009). Investment banks as insiders and the market for corporate control. *The Review of Financial Studies 22*(12), 4989–5026.

Böni, P. and S. Manigart (2022). Private debt fund returns, persistence, and market conditions. *Financial Analysts Journal 78*(4), 121–144.

Buchner, A., F. Lopez-de Silanes, and A. Schwienbacher (2022). Private equity debt funds: Who wins, who loses? Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4118522. Accessed: September 12, 2023.

Bushman, R. M., A. J. Smith, and R. Wittenberg-Moerman (2010). Price discovery and dissemination of private information by loan syndicate participants. *Journal of Accounting Research 48*(5), 921–972.

Cameron, A. C., J. B. Gelbach, and D. L. Miller (2011). Robust inference with multi-way clustering. *Journal of Business & Economic Statistics 29*(2), 238–249.

Chava, S., R. Wang, and H. Zou (2019). Covenants, creditors' simultaneous equity holdings, and firm investment policies. *Journal of Financial and Quantitative Analysis 54*(2), 481–512.

Chen, J., B. A. Jain, and J. Huang (2023). Proxy contests and debt contracting behavior: The interplay of managerial, shareholder and creditor incentives. *Journal of Business Finance & Accounting 50*(9-10), 1867–1909.

Chen, L., P. Collin-Dufresne, and R. S. Goldstein (2009). On the relation between the credit spread puzzle and the equity premium puzzle. *The Review of Financial Studies 22*(9), 3367–3409.

Chu, Y. (2018). Shareholder-creditor conflict and payout policy: Evidence from mergers between lenders and shareholders. *The Review of Financial Studies 31*(8), 3098–3121.

Clopremium (2022). Top 10 us clo managers: Clo aum (30 nov 2022). Available at https://clopremium.co.uk/top-10-us-clo-managers-clo-aum. Accessed: March 23, 2023.

Donde, A. (2016). Bain's sankaty rebrands. Available at https://www.privatedebtinvestor.com/bains-sankaty-rebrands/. Accessed: December 19, 2023.

Eisdorfer, A. (2008). Empirical evidence of risk shifting in financially distressed firms. *The Journal of Finance 63*(2), 609–637.

Fahlenbrach, R., S.-D. Rotermund, and S. Steffen (2023). What did banks learn from their exposure to the lbo loan market during the financial crisis? Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4298966. Accessed: October 30, 2023.

Fenn, G. W., N. Liang, and S. Prowse (1997). The private equity market: An overveiw. *Financial Markets, Institutions & Instruments 6*(4), 1–106.

Financial Stability Board (2019). Vulnerabilities associated with leveraged loans and collateralised loan obligations. Available at https://www.fsb.org/uploads/P191219.pdf. Accessed: February 8, 2023.

Fitch Ratings (2014). *CLO Asset Manager Handbook* (3rd ed.). New York, London.

Fritsch, L., W. Lim, A. Montag, and M. C. Schmalz (2022). Direct lending: Evidence from european and us markets. *Journal of Alternative Investments 24*(3), 80–98.

Geburtig, I., T. Mählmann, and R. Liebscher (2025). Dual holdings and shareholder–creditor agency conflicts: Evidence from the syndicated loan market. *Journal of Business Finance & Accounting 52*(1), 222–260.

Gore, G. (2019). Clos create boon for private equity, but others shoulder risk. International Finance Review. Available at https://www.ifre.com/story/1531332/clos-create-boon-for-private-equity-but-others-shoulder-risk-57h76yv6zx. Accessed: April 1, 2023.

Han, S. and X. Zhou (2014). Informed bond trading, corporate yield spreads, and corporate default prediction. *Management Science 60*(3), 675–694.

Harford, J. and A. Kolasinski (2014). Do private equity returns result from wealth transfers and short-termism? Evidence from a comprehensive sample of large buyouts. *Management Science 60*(4), 888–902.

Hotchkiss, E. S., D. C. Smith, and P. Strömberg (2021). Private equity and the resolution of financial distress. *The Review of Corporate Finance Studies 10*(4), 694–747.

Huang, J.-Z. and M. Huang (2012). How much of the corporate-treasury yield spread is due to credit risk? *The Review of Asset Pricing Studies 2*(2), 153–202.

Irvine, P., M. Lipson, and A. Puckett (2007). Tipping. *The Review of Financial Studies 20*(3), 741–768.

Ivashina, V. and A. Kovner (2011). The private equity advantage: Leveraged buyout firms and relationship banking. *The Review of Financial Studies 24*(7), 2462–2498.

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

Ivashina, V. and Z. Sun (2011b). Institutional stock trading on loan market information. *Journal of Financial Economics 100*(2), 284–303.

Jeng, L. A., A. Metrick, and R. Zeckhauser (2003). Estimating the returns to insider trading: A performance-evaluation perspective. *Review of Economics and Statistics 85*(2), 453–471.

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.

Jiang, W., K. Li, and P. Shao (2010). When shareholders are creditors: Effects of the simultaneous holding of equity and debt by non-commercial banking institutions. *Review of Financial Studies 23*(10), 3595–3637.

Kakouris, R. (2022). Amid more rate hikes, pe-backed leveraged loan issuers eye rising costs, outsized risk. Available at https://pitchbook.com/news/articles/amid-more-rate-hikes-pe-backed-leveraged-loan-issuers-eye-rising-costs-outsized-risk. Accessed: February 20, 2023.

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

Lim, J., B. A. Minton, and M. S. Weisbach (2014). Syndicated loan spreads and the composition of the syndicate. *Journal of Financial Economics 111*(1), 45–69.

Longstaff, F. A. and E. S. Schwartz (1995). A simple approach to valuing risky fixed and floating rate debt. *The Journal of Finance 50*(3), 789–819.

Loumioti, M. and F. P. Vasvari (2019). Portfolio performance manipulation in collateralized loan obligations. *Journal of Accounting and Economics 67*(2-3), 438–462.

Malenko, A. and N. Malenko (2015). A theory of lbo activity based on repeated debt-equity conflicts. *Journal of Financial Economics 117*(3), 607–627.

Martellozzo, D., S. Bertani, and L. Astegiano (2019). Clos at the center of the new pe industry. Sell Side Handbook. Available at http://sellsidehandbook.com/2019/03/18/clos-at-the-center-of-the-new-pe-industry/. Accessed: April 1, 2023.

Martin, J. and A. Sayrak (2022). Collateralized loan obligations: A primer. *Journal of Applied Corporate Finance 34*(3), 35–50.

Massoud, N., D. Nandy, A. Saunders, and K. Song (2011). Do hedge funds trade on private information? Evidence from syndicated lending and short-selling. *Journal of Financial Economics 99*(3), 477–499.

Merton, R. C. (1974). On the pricing of corporate debt: The risk structure of interest rates. *The Journal of Finance 29*(2), 449–470.

Meuleman, M., N. Wilson, M. Wright, and J. Neckebrouck (2022). When the going gets tough: Private equity firms' role as agents and the resolution of financial distress in buyouts. *Journal of Small Business Management 60*(3), 513–540.

Michala, D. (2019). Are private equity backed initial public offerings any different? Timing, information asymmetry and post-ipo survival. *Journal of Corporate Finance 59*, 31–47.

Milde, H. and J. G. Riley (1988). Signaling in credit markets. *The Quarterly Journal of Economics 103*(1), 101–129.

Morningstar (2022). Morningstar lsta us leveraged loan index. Available at https://indexes.morningstar.com/docs/overview/morningstar-lsta-us-leveraged-loan-index-FSUSA084ZT. Accessed: March 27, 2023.

Morningstar (2023). Morningstar european leveraged loan index. Available at https://indexes.morningstar.com/docs/overview/morningstar-european-leveraged-loan-index-FS0000CXKD. Accessed: March 27, 2023.

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

Nozawa, Y. (2017). What drives the cross-section of credit spreads?: A variance decomposition approach. *The Journal of Finance 72*(5), 2045–2072.

Odean, T. (1998). Are investors reluctant to realize their losses? *The Journal of Finance 53*(5), 1775–1798.

Shivdasani, A. and Y. Wang (2011). Did structured credit fuel the LBO boom? *The Journal of Finance 65*(4), 1291–1327.

Smith, C. W. and J. B. Warner (1979). On financial contracting: An analysis of bond covenants. *Journal of Financial Economics 7*(2), 117–161.

Smith, P. and J. Politi (2006). Kkr in record $33bn deal for hca. Available at https://www.ft.com/content/63845bbe-1aca-11db-848c-0000779e2340. Accessed: December 19, 2023.

S&P Global Market Intelligence Inc. (2020). Leveraged commentary & data (lcd): Leveraged loan primer. Available at https://www.lcdcomps.com/d/pdf/LCD%20Loan%20Primer.pdf. Accessed: October 22, 2023.

Sudarsanam, S., M. Wright, and J. Huang (2011). Target bankruptcy risk and its impact on going private buyout performance and exit. *Corporate Governance: an international review 19*(3), 240–258.

Tan, G. (2014). Vista private equity's robert smith and brian sheth. The Wall Street Journal. Available at http://blogs.wsj.com/moneybeat/2014/10/15/qa-vista-private-equitys-robert-smith-and-brian-sheth. Accessed: October 30, 2016.

Tykvová, T. (2017). When and why do venture-capital-backed companies obtain venture lending? *Journal of Financial and Quantitative Analysis 52*(3), 1049–1080.

Tykvová, T. and M. Borell (2012). Do private equity owners increase risk of financial distress and bankruptcy? *Journal of Corporate Finance 18*(1), 138–150.

Wilson, N. and M. Wright (2013). Private equity, buy-outs and insolvency risk. *Journal of Business Finance & Accounting 40*(7-8), 949–990.

Yoshizawa, Y. (2003). Moody's approach to rating synthetic CDOs. Available at http://globalriskguard.com/resources/crderiv/Moody's%20synthetic%20CDO.pdf. Accessed: November 05, 2016.

II. Appendices

II. Appendix A: Variables

Table II.A.1: This table presents the variables used in our analysis.

Variable	Source	Unit	Description
Panel A: Metric Facility Characteristics			
# Dealers	IHS Markit	count	Number of dealers quoting the loan facility at a specific trading date.
# Facilities	DealScan	count	Number of facilities in the loan package (PackageID).
# Manager	CLO-i (own computation)	count	Number of CLO managers that currently hold the facility.
# Syndicate Members	DealScan	count	Number of lenders in the syndicate according to DealScan.
5yr Lead-Company-Vol	DealScan	Mio. USD	For every lead arranger of the facility the sum of all inflation-adjusted facility amounts the arranger had with the same company in the five years prior to the issuance date is computed. The mean value across all lead arrangers is taken.
5yr Lead-Sponsor-Vol	DealScan	Mio. USD	For every lead arranger-sponsor combination of the facility, the sum of all inflation-adjusted facility amounts the arranger had (as lead arranger) with the sponsor in the five years prior to the issuance date is computed. The mean value across all sponsor-lead arranger combinations is taken.
5yr Sponsor Market Share	DealScan	%	The ratio of the sponsor's sum of all facility amounts in the five years prior to issuance to the total amount issued in this time.
AISD	DealScan	basis points	All-In-Spread-Drawn, defined as the sum of the spread over LIBOR or EURIBOR plus the facility fee.

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Variable	Source	Unit	Description
Control-adjusted Return	IHS Markit (own computation)	%	(midquote treatment $\text{loan}_{\text{after takeover}}$ /midquote treatment $\text{loan}_{\text{pre takeover}} - 1$) $-1/3 * \sum_{k=1}^{3}((\text{midquote control loan}_{\text{k, after takeover}}$ /midquote control $\text{loan}_{\text{k, pre takeover}} - 1))$
Effective Spread	DealScan, CLO-i	% or basis points	Effective spread, defined as the sum of AISD and the price discount distributed over four years: Effective Spread = AISD in % + (100 − price)/4. In most analyses converted into bp.
Facility Amount	DealScan, FRED	Mio. USD	Facility amount as available from DealScan adjusted to end of 2015 USD (FRED ticker CPIAUCSL).
Maturity	CLO-i, DealScan	years	Difference between variables *FacilityEndDate* and *FacilityStartDate* from DealScan divided by 365. If *FacilityEndDate* is not available in DealScan then Maturity is computed as the difference between the expiration date according to CLO-i minus *FacilityStartDate* from DealScan. In the quasi-experiment the last day in the penultimate month before the takeover event is used instead of the *FacilityStartDate*.
Moody's PD	CLO-i, Yoshizawa (2003)	%	One year rating-implied probability of default. The measure is constructed by mapping Moody's rating into an idealized default rate using the table in Yoshizawa (2003, p. 19).
Pre-event Price	IHS Markit	%	Midquote of the loan at the last trading date in the penultimate month before the CLO takeover event.
Price at Issuance	CLO-i	%	Price CLOs paid at the issuance date of a facility.
PD	CLO-i (own computation)	%	Mean of Moody's PD and S&P's PD.

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Variable	Source	Unit	Description
Unaffiliated Funding	CLO-i (own computation)	%	$\sum_i$ CLO Investments$_i$/Facility Amt across all CLOs with managers unaffilaited to PE firms sponsoring the issuing company, measured at the primary market.
S&P PD	CLO-i, Barnett-Hart (2009)	%	One year rating-implied probability of Default. The measure is constructed by mapping S&P's rating into an idealized default rate using the table in Barnett-Hart (2009, p. 113).
Panel B: Facility Indicator Variables			
Bond Dummy	DealScan	0/1	Indicator variable that is one if the facility is a bond.
Country	DealScan	factor	Indicator variable for the country of loan origin.
Dual Holding	CLO-i, DealScan (own computation)	0/1	Indicator variable that is one if at least one of the company's outstanding loans is among the portfolio holdings of a CLO manager belonging to the same group as one of the company's current sponsoring PE firms. See *Panel C* for the slightly diverging definition on the trade-level.
Industry	DealScan	factor	Indicator variable for the 2-digit obtained from variable *PrimarySICCode* in DealScan.
LBO/SBO	DealScan	0/1	Dummy that is one if *PrimaryPurpose* of loan is "LBO" or "SBO".
Loan Type	CLO-i, DealScan	factor	Indicator variable for the nature of the loan tranche (e.g. institutional term loan, revolving credit line)
Performance Pricing	DealScan	0/1	Dummy that is one if facility has a performance pricing schedule.
Rated	CLO-i	0/1	Dummy that is one if the facility is rated.

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Variable	Source	Unit	Description
Rating Letter	CLO-i	factor	Indicator variable for letter of average rating from S&P, Moody's and Fitch. For the by far most common letter B, there is a separate indicator for the B+, B and B- notch.
Secured	DealScan	0/1	Dummy that is one if facility is secured.
Sponsor	DealScan	factor	Indicator variable that captures the exact composition of sponsors in alphabetical order (i.e. "Blackstone Group, CVC Capital Partners").
US	DealScan	0/1	Dummy that is one if *Country* is "USA".
USD	CLO-i	0/1	Dummy that is one if facility is denominated in USD.
Panel C: Trade-Level Variables			
Distress	CLO-i (own computation)	0/1	Binary indicator that is one if price of traded facility is below the median of all traded facilities in the same quarter.
Dual Holding	CLO-i, DealScan (own computation)	0/1	Indicator variable that is one if the trading CLO manager belongs to the same group as one of the company's sponsoring PE firms. See *Panel B* for the slightly diverging definition on the facility-level.
Excess Return	CLO-i, S&P (own computation)	%	$(1+(\text{realized sale price/realized buy price}-1)-(\text{LLI}_{\text{price index, sale date}}/\text{LLI}_{\text{price index, buy date}}-1))^{1/\text{Holding Time}_{\text{years}}}-1$
Holding Time	CLO-i (own computation)	days	Difference between sale and purchase date. If more than one purchase is associated with the sale the principal weighted average of the time differences is computed.
Trade Volume	CLO-I	mio. USD	One-sided volume of roundtrip trade (purchase and sale)
Panel D: Macro Variables			

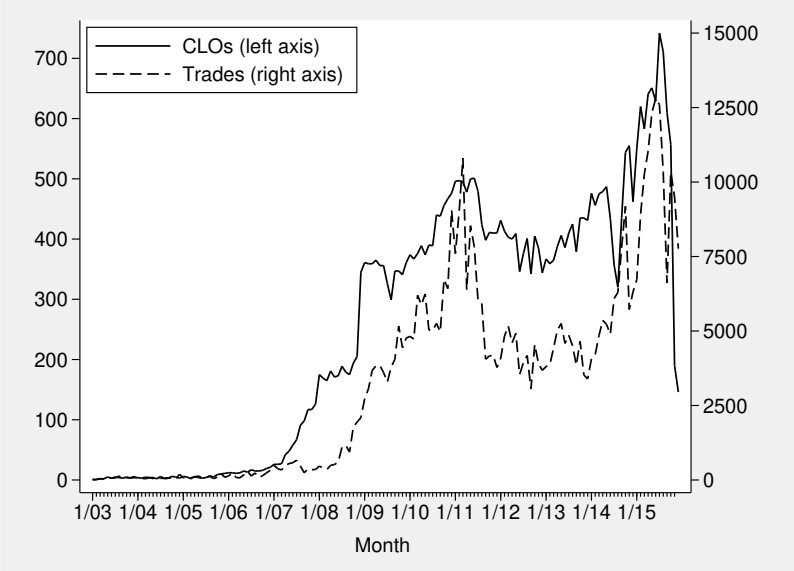
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Variable	Source	Unit	Description
HY bond spread over LIBOR	Merril Lynch, FRED	%	U.S. High Yield Corporate Bond Index (Yield) minus 3-month-LIBOR motivated by its use as proxy for debt market conditions in Axelson et al. (2013).

II. Appendix B: Trading and holding data from CLO-i

We obtain data on CLO trading activity and portfolio composition from CLO-i. We drop all observations that belong to structured finance instruments or equity securities. Moreover, we delete duplicate entries and delete restructurings which we identify as purchases and sales with the same size and in the same borrower, at the same date, at the same price. Figure II.A.1 shows the final number of CLOs and trades in each month of our sample period.

Figure II.A.1: This figure shows the number of trades and portfolio observations. The trade series is based only on loans and bonds but no equities or structured finance products. For the portfolio observations we only count one observation per CLO-month.

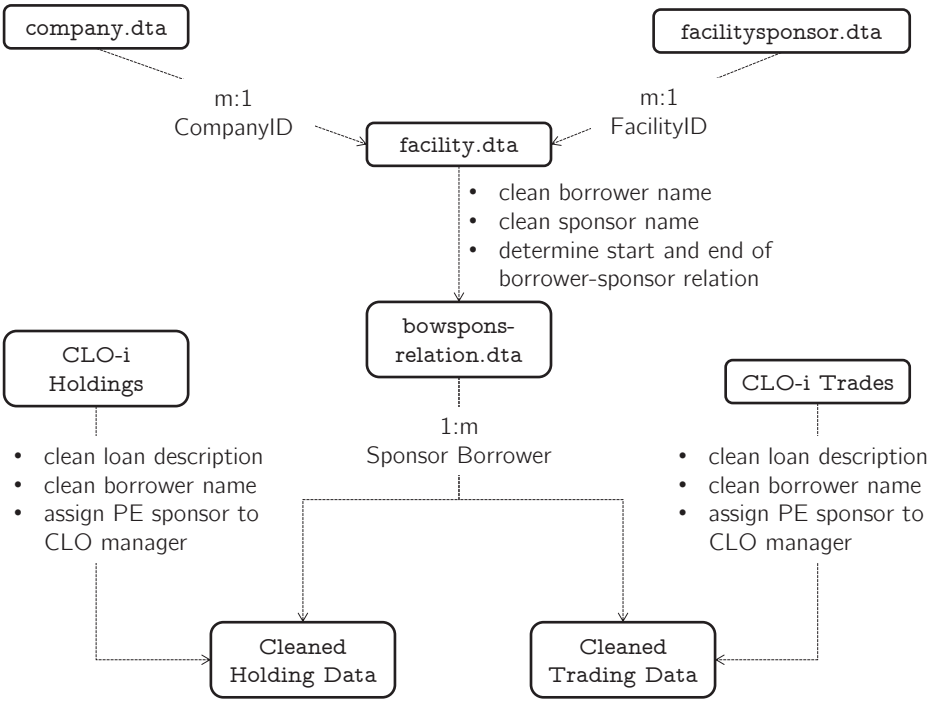


II. Appendix C: Loan and borrower matching between CLO-i and DealScan

Although DealScan provides a – not always unique – identifier (LIN) CLO-i does not offer such a variable. This complicates the matching of the two databases. Therefore, we conduct

a rigorous revision of the crucial string variables in DealScan and CLO-i. This involves, e.g., the loan description in CLO-i as well as the name of the borrower. Specifically, we rename the borrower to conform with the name in DealScan. As for the DealScan data, we aggregate different borrower names in case they represent the same legal entity or are subsidiaries of one and the same parent firm. We further clean the sponsor variable in DealScan. For instance, we aggregate the sponsors named "Kravis Kohlberg Roberts", "Kohlberg Kravis Roberts & Co [KKR]", "KKR Capital Markets" etc. to one single entity labelled "KKR". This enables us to measure the relationship variables more precisely. Moreover, we use this cleaned data for the identification of the borrower-sponsor-relation (see Section II.2.3). Figure II.A.2 illustrates how we merge the cleaned datasets to finally identify dual holdings.

Figure II.A.2: This figure illustrates the matching procedure to identify dual holdings.



Because the *FacilityEndDate* and *LoanType* variables in DealScan have counterparts in CLO-i we are able to match DealScan data with CLO-i on a loan-by-loan basis. To identify the appropriate loan we merge all sponsored loans of a borrower in DealScan to all observations of the same borrower in CLO-i. To nail down the "correct" match we successively delete

observations based on a comparison of the variables in DealScan with those in CLO-i[28]:

1. We delete loan tranches whose issuance date (*FacilityStartDate*) comes later than the holding date (or trade date) in CLO-i.

2. We drop observations where the holding or trade date in CLO-i is later than the maturity of the loan according to DealScan (*FacilityEndDate*).

3. We exclude observations where the maturity in CLO-i and the *FacilityEndDate* in DealScan differ by more than 30 days.

4. From the remaining observations we keep all cases where the *LoanType* variable from DealScan aligns with the corresponding variable in CLO-i, i.e., we match institutional loan tranches to institutional loan tranches, revolving loans to revolvers and bank loan tranches to bank loan tranches etc.

5. Based on the loan description in CLO-i we construct a *Seniority* variable like the one in DealScan and drop subordinated loans[29] that have been matched to senior loans from DealScan and vice versa.

6. We drop observations where the "coupon" in CLO-i (the yield) is *smaller* than the *AISD* in DealScan.

7. From the resulting matches we search for the observation[30]:

   (a) with the same Loan Identification Number (LIN)

   (b) with the same spread

   (c) with the LoanType closest to the issue in CLO-i. For example, from the two remaining matches of the LoanTypes "Term Loan" and "Term Loan B" we would take the latter if the issue according to CLO-i is "Term Loan B".

[28] Data in CLO-i has been cleaned before this procedure is applied. The clearance includes borrower names, maturities, loan descriptions and the issue variable.

[29] We define a loan as subordinated if the description contains one of the words "subordinated", "second lien", "third lien" or "junior".

[30] In descending order. If variables are not in both datasets, go to next step. The LIN and spread information in the CLO-i data was manually added by us in a few cases and is not available in the original data.

(d) with the smallest difference between maturity according to CLO-i and *FacilityEnd-Date*.

II. Appendix D: Sponsor size and dual holding effect

In section II.3.1 we found a, depending on the model, 32-42 bp reduction effect through dual holdings. Even though we used sponsor FEs, we don't know if the effect is concentrated in a specific set of sponsors sharing similar characteristics. As big asset management groups typically have both, a large equity and debt portfolio, the probability of a dual holding should increase in companies sponsored by them. Thus we would expect a higher fraction of ones in the *Dual Holding* dummies of loan facilities, whose issuing companies are sponsored by the PE firms of large asset management groups.

We use the occurrence of a group's PE firm in our data set as sponsor as a proxy for its size during our sample period. The five asset management groups that most frequently appear as equity sponsors are "Blackstone Group", "KKR", "Carlyle Group", "Bain Capital" and "TPG Capital". Just under 20% of the facilities in our sample are issued by a company sponsored by at least one of these five *large* sponsors. However, this fifth of loan facilities accounts for approximately 60% of all dual holdings in our sample underlining the dominance of big sponsors among dual holding companies.

Next, we want to evaluate whether loans to portfolio companies of these sponsors are also the main driver behind the dual holding reduction effect. Therefore, we repeat the spread regression from Table II.2 separately for the subsample of loans issued by companies with and without a large equity sponsor. By large sponsors, we mean the PE firms belonging to the five asset management groups listed above. In the following, we refer to the sample of loan facilities issued by companies without any of these five sponsors as small sponsor sample.

Table II.A.5 shows the regression results for all four model specifications from Table II.2. The *Dual Holding* coefficients are negative and in a similar order of magnitude as in the full sample regression. The absolute values of the coefficients in the large sponsor sample are slightly smaller than in the full sample, with differences in the single-digit bp range. In the *Effective Spread* models, the *Dual Holding* coefficient loses its statistical significance for the large sponsors

sample, which primarily results from an 80 % smaller sample size. For the small sponsor sample on the other hand, the estimated effect is, depending on the model, between 9 and 12 bp larger than for the full sample. Hence, the regression results indicate no specific role for the companies with large equity sponsors and high dual holding share in the spread reduction effect. If anything, the estimated coefficients hint to a slightly smaller dual holding effect, if the issuer is sponsored by a large asset management group.

II. Appendix E: Additional Tables

Table II.A.2: This table presents summary statistics for the treatment and control loans of the quasi-experiment in Table II.4. Panel A refers to the samples, with control loans that are part of the same CLO portfolio as their matched treatment loan. Panel B shows the statistics for the samples with control loan facilities issued by companies with the same sponsoring PE firm as the borrowing company in the corresponding treatment loan. The subtables with suffix .1 show data for the samples with newly emerging dual holdings, while those with suffix .2 refer to samples, in which the borrowing companies of the treatment loans already have dual-holding investors prior to the event. The p-value originates from a Welch's t-test, comparing the variable means of the treatment and control loans. All variables are explained in Table II.A.1 in the appendix.

Panel A: Matching universe: CLO holdings

A.1: New DH	Treatment Loans				Control Loans				
	N	mean	sd	median	N	mean	sd	median	p-vaule
Pre-event Price	52	91.26	8.93	92.58	148	92.58	7.79	93.46	0.35
Rated	52	0.92	0.27	1	148	0.93	0.26	1	0.95
Rating Letter	48			B	137			B	
Maturity	52	4.77	1.71	4.23	148	4.72	1.85	4.5	0.85
# Dealers	50	5.56	3.54	4.5	146	4.47	3.34	4	0.06
A.2: Existing DH	Treatment Loans				Control Loans				
	N	mean	sd	median	N	mean	sd	median	p-vaule
Pre-event Price	83	93.70	11.37	97.16	256	95.02	7.34	97.31	0.32
Rated	83	0.88	0.33	1	256	0.86	0.35	1	0.63
Rating Letter	73			B	220			B	
Maturity	83	4.13	1.37	4.01	256	4.10	1.36	3.84	0.83
# Dealers	82	5.66	3.30	6	254	5.49	3.60	5	0.69

Panel B: Matching universe: PE firm holdings

B.1: New DH	Treatment Loans				Control Loans				
	N	mean	sd	median	N	mean	sd	median	p-vaule
Pre-event Price	50	91.66	8.65	92.58	110	94.25	7.98	96.11	0.08
Rated	50	0.94	0.24	1	110	0.95	0.21	1	0.71
Rating Letter	47			B	105			B	
Maturity	50	4.76	1.83	4.23	110	3.99	1.48	4.21	0.01
# Dealers	48	5.35	3.43	4	109	2.90	2.13	2	0.00
B.2: Existing DH	Treatment Loans				Control Loans				
	N	mean	sd	median	N	mean	sd	median	p-vaule
Pre-event Price	80	94.76	7.87	97.23	228	94.06	5.40	94.51	0.46
Rated	80	0.90	0.30	1	228	0.95	0.21	1	0.16
Rating Letter	72			B	217			B	
Maturity	80	4.18	1.37	4.08	228	4.10	1.31	4.08	0.68
# Dealers	79	5.82	3.25	6	202	4.89	3.30	4	0.03

Table II.A.3: This table presents results from spread regressions for the subsample of facilities with the loan purpose "LBO". The dependent variable is the *Effective Spread* in Columns (1) and (2) or the *AISD* in Columns (3) and (4). The independent variable *Dual Holding* captures whether a PE sponsor of the borrowing company has an affiliated CLO manager investing in at least one of the company's loan facilities. Variables are explained in Table II.A.1 in the appendix. The constant is not reported. Standard errors are clustered at the company level with the corresponding p-values reported in parentheses.

	Effective Spread		AISD	
	(1)	(2)	(3)	(4)
Dual Holding	-55.278	-49.500	-46.544	-41.912
	(0.003)	(0.010)	(0.001)	(0.003)
Unaffiliated Funding	-1.014	-0.874	-0.459	-0.409
	(0.001)	(0.004)	(0.174)	(0.216)
Log(# Syndicate Members)	-28.486	-26.483	-14.405	-13.319
	(0.013)	(0.017)	(0.113)	(0.140)
# Facilities	-6.652	-2.208	5.936	7.587
	(0.245)	(0.712)	(0.141)	(0.071)
Log(Facility Amount)	-13.286	-13.937	-17.942	-17.679
	(0.046)	(0.037)	(0.001)	(0.001)
Log(Maturity)	77.809	65.963	187.862	182.077
	(0.010)	(0.020)	(0.000)	(0.000)
Secured	-4.867	-4.253	-45.566	-45.129
	(0.889)	(0.905)	(0.092)	(0.096)
Performance Pricing	-54.559	-52.941	-44.536	-44.130
	(0.001)	(0.003)	(0.000)	(0.000)
HY bond spread over LIBOR	57.122	56.166	20.923	20.190
	(0.000)	(0.000)	(0.000)	(0.000)
Log(1+5yr Lead-Company-Vol)		-5.644		-2.792
		(0.003)		(0.073)
Log(1+5yr Lead-Sponsor-Vol)		-1.719		-1.281
		(0.560)		(0.506)
Year FE	Yes	Yes	Yes	Yes
Loan Type FE	Yes	Yes	Yes	Yes
Rating Letter FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Sponsor FE	Yes	Yes	Yes	Yes
N	937	937	1519	1519
adj. R^2	0.550	0.558	0.487	0.489

Table II.A.4: This table presents results from OLS regressions of annualized *Excess Returns* on the *Dual Holding* dummy and controls. Specifically and contrary to Table II.7, we add a variable that captures the change in the rating-implied one-year PD between purchase and sale date (ΔPD). The dependent variable is winsorized at the 1% and 99% percentile. The constant is not reported. Columns (1) through (3) show results for a sample of PE-affiliated and unaffiliated managers, whereas Columns (3) to (6) are only for a subsample of trades from managers affiliated to a PE firm. In Columns (7) through (9) the sample is confined to observations from affiliated borrowers. Standard errors are double-clustered (Cameron et al., 2011) along sale date quarters and borrower names with the corresponding p-values reported in parentheses.

	Dependent variable: Annualized Excess Return in %								
	Full Sample			Only Affiliated Managers			Only Affiliated Borrowers		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dual Holding	2.605	2.573	3.115	2.637	2.165	3.087	3.604	2.239	3.884
	(0.065)	(0.005)	(0.077)	(0.056)	(0.034)	(0.036)	(0.007)	(0.025)	(0.037)
Log(Trade Volume)	0.270	0.091	0.446	0.132	-0.034	0.226	0.689	0.358	0.853
	(0.225)	(0.558)	(0.087)	(0.644)	(0.884)	(0.384)	(0.019)	(0.260)	(0.007)
Log(Holding Time)	-9.534	-9.759	-9.522	-9.713	-9.806	-9.671	-8.403	-8.701	-8.494
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bond Dummy	5.189	6.899	5.149	5.755	6.838	6.099	8.579	12.015	8.846
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.006)	(0.008)
USD Dummy	1.648	-0.096	2.809	0.593	0.488	2.104	2.931	0.447	5.336
	(0.151)	(0.960)	(0.050)	(0.625)	(0.827)	(0.133)	(0.078)	(0.823)	(0.047)
Δ PD	-0.173	-0.094	-0.180	-0.128	-0.083	-0.129	-0.403	-0.304	-0.358
	(0.003)	(0.103)	(0.015)	(0.035)	(0.078)	(0.029)	(0.004)	(0.167)	(0.006)
Borrower FE	No	Yes	No	No	Yes	No	No	Yes	No
Manager FE	No	No	Yes	No	No	Yes	No	No	Yes
Rating Letter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	44,484	44,484	44,484	22,107	22,107	22,107	10,299	10,299	10,299
Adj. R^2	0.295	0.409	0.314	0.313	0.469	0.320	0.308	0.356	0.336

Table II.A.5: This table presents results from spread regressions separately for the subsample of facilities sponsored by at least one (Sponsor Size: Large) or none (Sponsor Size: Small) of the five most common PE firms in our sample. The dependent variable is the *Effective Spread* in Columns (1)-(4) or the *AISD* in Columns (5)-(8). The independent variable *Dual Holding* captures whether a PE sponsor of the borrowing company has an affiliated CLO manager investing in at least one of the company's loan facilities. Variables are explained in Table II.A.1 in the appendix. The constant is not reported. Standard errors are clustered at the company level with the corresponding p-values reported in parentheses.

	Effective Spread				AISD			
Sponsor Size	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dual Holding	-31.329	-52.107	-24.589	-44.587	-41.198	-50.992	-36.741	-46.429
	(0.106)	(0.000)	(0.189)	(0.001)	(0.022)	(0.000)	(0.039)	(0.000)
Unaffiliated Funding	-1.059	-0.383	-1.018	-0.303	-0.831	-0.366	-0.838	-0.326
	(0.003)	(0.012)	(0.005)	(0.028)	(0.011)	(0.006)	(0.013)	(0.013)
Log(# Syndicate Members)	-9.185	-11.712	-11.087	-10.302	-10.741	-15.828	-9.012	-14.370
	(0.380)	(0.052)	(0.260)	(0.082)	(0.207)	(0.001)	(0.230)	(0.001)
# Facilities	-9.482	0.398	-5.588	3.634	3.027	2.094	4.789	4.067
	(0.193)	(0.922)	(0.434)	(0.363)	(0.458)	(0.515)	(0.257)	(0.211)
Log(Facility Amount)	-27.850	-19.792	-25.361	-17.069	-13.741	-21.833	-12.285	-20.133
	(0.001)	(0.000)	(0.001)	(0.000)	(0.008)	(0.000)	(0.017)	(0.000)
Log(Maturity)	40.940	84.400	25.328	64.892	55.200	86.729	44.802	78.503
	(0.210)	(0.000)	(0.418)	(0.000)	(0.140)	(0.000)	(0.225)	(0.000)
LBO/SBO	-5.623	22.109	-30.122	2.609	-16.863	13.834	-29.851	1.329
	(0.750)	(0.005)	(0.111)	(0.744)	(0.218)	(0.016)	(0.040)	(0.828)
Secured	39.907	2.785	35.347	8.085	18.138	-14.668	15.660	-12.420
	(0.163)	(0.901)	(0.211)	(0.718)	(0.554)	(0.371)	(0.621)	(0.458)
Performance Pricing	-53.771	-41.418	-47.922	-39.697	-46.179	-34.949	-42.884	-33.662
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HY bond spread over LIBOR	31.078	45.509	28.994	43.797	11.877	23.057	8.813	22.057
	(0.016)	(0.000)	(0.025)	(0.000)	(0.176)	(0.000)	(0.328)	(0.000)
Log(1+5yr Lead-Company-Vol)			-6.855	-9.052			-3.302	-5.167
			(0.006)	(0.000)			(0.066)	(0.000)
Log(1+5yr Lead-Sponsor-Vol)			-6.723	-2.259			-7.112	-2.314
			(0.542)	(0.190)			(0.210)	(0.082)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rating Letter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sponsor FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	511	2195	511	2195	774	3210	774	3210
adj. R^2	0.547	0.484	0.564	0.510	0.482	0.487	0.488	0.498

III. Affiliated investment bias in collateralized loan obligations

Ingo Geburtig * Thomas Mählmann* Roberto Liebscher*

Abstract

Collateralized loan obligation (CLO) managers are often part of asset management groups that also operate private equity (PE) firms. This paper examines whether these CLO managers exhibit a bias towards loans to companies sponsored by their affiliated PE firms. We find that CLO managers overweight these affiliated investments in their portfolios. Purchase level analyses reveal that the positive relationship between affiliation and investment is highly concentrated in primary market trades. Evidence suggests that the affiliated investment bias is partially explained by group-level incentives to support the funding of the PE firm's portfolio companies. Moreover, preferential allocations by loan arrangers contribute to the observed bias.

Keywords: Leveraged loans, collateralized loan obligations, affiliated investments, funding support, primary market allocations

JEL Classification: G11, G23, G32

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III.1 Introduction

Leveraged loans are a segment of corporate lending characterized by high interest rates that compensate loan investors for an increased risk of default. S&P Global Market Intelligence Inc. (2020) defines leveraged loans as loans with a rating of BB+ or lower or a spread over the risk-free interest rate of 125 basis points (bp) or higher. As these loans are typically broadly syndicated by the arranging investment banks, a large market for institutional investors has emerged. Between 2000 and 2022, the average annual issuance volume of institutional tranches (334 billion USD) has even slightly exceeded that of bank-held pro rata facilities (332 billion USD) in the US (Fitch Ratings, 2023). Among institutional leveraged loan investors, collateralized loan obligations (CLOs) are the most important group, holding about 50% of the outstanding loan volume (Financial Stability Board, 2019).

In the leveraged loan segment, approximately 60% of the borrowing companies are sponsored by a Private Equity (PE) firm (Kakouris, 2022). The asset management groups that run these sponsoring PE firms also frequently operate CLO managers. As a result of these corporate structures, PE-affiliated CLO managers often invest in loans issued by companies with a PE sponsor belonging to the same group as the CLO manager itself (Geburtig et al., 2025). In the following, we refer to these portfolio components as *affiliated investments*.

To illustrate this concept, we use the asset management group Bain Capital as an example. In 2006, Bain Capital Private Equity joined forces with KKR and Merrill Lynch to acquire HCA, the largest hospital operating company in the U.S. (Smith and Politi, 2006). The following year, Bain Capital's CLO manager, Sankaty Advisors, launched Race Point IV CLO.[1] Over time, this CLO invested in three different loan facilities issued by HCA. Since HCA was a portfolio company of Bain Capital Private Equity, we classify these holdings as affiliated investments.

While the overlap of companies in the investment universes of PE firms and CLO managers inevitably leads to some affiliated investments, it is unclear whether their proportion exceeds the market-neutral level in the portfolios of PE-affiliated CLOs. This brings us to our first research question: *Do PE-affiliated CLO managers exhibit a bias towards affiliated loan investments?*

[1] Since a rebranding in 2016 Sankaty advisors operates under the name Bain Capital Credit (Donde, 2016).

As there is no natural benchmark for the composition of CLO portfolios, we analyze the *affiliated investment bias* in two ways. First, we use portfolios of other CLOs with similar characteristics, but operated by different managers as a benchmark. We compare the proportion of affiliated investments in our PE-affiliated sample CLOs to the fraction of loans in the benchmark portfolio that would qualify as affiliated investments if they were part of the sample CLO portfolio. Using this *benchmark portfolio approach*, we find a significant overweighting of affiliated loan investments in CLO portfolios by a factor of more than two on average.

While comparing portfolio weights to a benchmark gives a good indication of the bias, it doesn't account for the availability of affiliated investments at the time of a loan purchase. For that reason, we use a second approach that measures the affiliated investment bias at the level of individual loan purchase decisions. We do this by generating a sample of all monthly combinations between CLOs purchasing at least one loan and loan facilities bought by at least one CLO. We then regress a dummy variable indicating whether the CLO has actually realized the potential purchase of the loan on the affiliation status between the observed CLO and loan facility. Adopting this *potential dyads approach* (Lin and Viswanathan, 2016), the results of most regression models indicate that the likelihood of a CLO purchasing a loan increases by 30%-35% of the unconditional purchase probability if the manager is affiliated with a sponsor of the issuing company.

Including all pair-wise monthly combinations of purchasing CLOs and purchased loan facilities in our sample implies that, in principle, every facility is a feasible investment for all CLOs. However, in practice, some combination of facility and CLO characteristics, such as risk levels, maturities or CLO covenants, may make it difficult or impossible for a specific CLO to invest in a particular loan facility. Part of the observed CLO-loan facility combinations occur more than once in our potential dyads dataset. Sometimes, the affiliation status of the potential investment changes between these occasions, either through the takeover of the CLO manager by a PE-affiliated group or through a change in the PE sponsor of the facility's borrowing company. By implementing CLO-facility fixed effects, we can exploit this potentially exogenous variation and measure the effect of the affiliation status within the same CLO-facility combination. Doing so results in more than a doubling of the observed effect, indicating that the other models may

even underestimate the affiliated investment bias in loan purchase decisions.

The finding of a significant affiliated investment bias in PE-affiliated CLO managers naturally raises a follow-up question: *What causes the bias towards affiliated loan investments?* One apparent explanation is that asset management groups often implement cross-divisional investment strategies related to company-specific characteristics. An example would be a focus on a specific industry in which the group has greater investment expertise. Such group-level preferences may result in coinciding target companies of the CLO manager and the PE firm, leading to an overweight of affiliated investments. We have no reason to assume that these company characteristic preferences differ between loan purchases in the primary and secondary market. Thus, under the *similar preferences hypothesis*, we would expect the effect of the affiliation status on investment decisions to be in the same order of magnitude in both of the market segments. However, when we repeat the potential dyads regression controlling for the market segment, we find that the affiliation bias appears almost exclusively in the primary market, arguing against similar company preferences as the driving factor behind the phenomenon.

In light of this finding, we continue by examining potential mechanisms that may cause a bias towards affiliated investments and are specifically linked to the primary market. For this purpose, we introduce the *affiliated funding bias* (AFB) as new measurement at the facility level. The AFB represents the difference between the affiliated CLOs' fraction of primary market purchases in the observed facility and their overall share of all loan purchases in our dataset during the facility's syndication period. We make the market-level adjustment, as we would expect affiliated funding to be proportional to the overall purchase activity of affiliated CLOs in absence of any bias. In line with the results of the benchmark portfolio and potential dyads approach, we find an approximately twofold increase in the volume of funding through affiliated CLOs compared to the level that would be implied by their market-wide purchase volume.

One potential mechanism behind the affiliated investment bias in the primary market is the group-level incentive to improve the funding conditions of the PE firm's portfolio companies by investing in their newly issued loans via the affiliated CLO manager. Since this funding support is more important in times of difficult financing conditions, we would expect the bias to be particularly pronounced in these periods if this mechanism were a driving factor behind the

bias. As suggested by Ivashina and Sun (2011), we use the average length of the syndication process as an indicator of the financing conditions at the time of loan issuance. Including this variable in a regression framework, we find a positive relationship between the average length of the syndication process and the AFB. This result is consistent with the prediction of the *funding support hypothesis*, as well as the findings of Gil-Bazo et al. (2020) on the funding support of bank-affiliated mutual funds.

In the primary loan market, the affiliation bias may result not only from the actions of the investing CLO managers, but also from preferential allocations by arrangers to CLO managers affiliated with PE sponsors of the issuing companies. IPO literature has identified two mechanisms that may support the *preferential allocation hypothesis*. Benveniste and Spindt (1989) argue that underwriters allocate underpriced shares to investors in order to incentivize them to reveal private information about the value of the issue. Assuming a positive relationship between an investor's level of information and the value of revealing it, we expect a preferential allocation to highly informed bidders. Applying this rationale to the leveraged loan market, CLO managers, who may benefit from information exchange with their affiliated PE firms, should receive preferential allocations in affiliated primary market investments. We refer to this rational as *information revelation channel*.

Loughran and Ritter (2002) postulate that IPO underwriters use preferential allocations to reward investors for past business revenue generation and to incentivize them to maintain a close business relationship. As the revenue generation is unrelated to the IPO itself, but based on past trading activity or the provision of other financial services, this mechanism operates in a rather indirect manner. However, in a loan issuance where a PE firm affiliated with a bidding CLO manager is sponsoring the issuing company, the PE firm has generated new business revenue by commissioning the arranger for the loan syndication in the first place. Therefore, rewarding the affiliated CLO manager through preferential allocations would be much more directly related to the process of generating business revenue. We call this potential mechanism of preferential allocations to affiliated CLO managers the *revenue generation channel*.

As the value of revealing information increases with the degree of uncertainty, we expect a higher AFB when the pricing of a loan issuance is more difficult under the information revelation

hypothesis. We utilize the trading frequency of other outstanding loan facilities of the borrowing company during the three months preceding a loan issuance as an inverse proxy for the level of pricing uncertainty. Regarding the revenue generation channel, we expect the AFB of a facility to be positively related to the mutual loan issuance volume of the lead arrangers and PE sponsors of the issuing company over the previous five years. This reflects the implication that the willingness of lead arrangers to reward revenue generation through excess allocations increases with the value of maintaining the business relationship. Using the same regression framework as for the funding support hypothesis, we find a positive relationship between the AFB and the past volume of joint loan issuances. On the other hand, the trading frequency of other facilities issued by the same company is negatively associated with the AFB. Both results confirm the predictions of the preferential allocation hypothesis and suggest that both the revenue generation and information revelation channel contribute to this phenomenon.

Our paper contributes to the literature on biases towards investments in affiliated companies. Ferreira et al. (2018) find that bank-affiliated mutual funds overweight stocks of their parent bank's creditors in their portfolios. Gil-Bazo et al. (2020) show that new bond issuances by banks are disproportionately funded by affiliated mutual funds. Moreover, research has identified biases towards the IPO clients of affiliated banks in both mutual funds (Hao and Yan, 2012) and hedge funds (Zheng and Yan, 2021). To the best of our knowledge, this paper is the first to investigate the bias towards affiliated investments in the institutional loan market. While private markets are generally less researched than public markets, their economic relevance for investors and corporate financing is large. With an outstanding volume of 1,670 billion USD in 2022, leveraged loans were the largest market for non-investment grade debt in the U.S., even exceeding the size of the high-yield bond market (Fitch Ratings, 2023).

Furthermore, we add to the literature on corporate affiliations of CLO managers and PE firms. Geburtig et al. (2025) observe lower credit spreads for loans to companies with equity and debt held by PE firms and CLO managers of the same group. The evidence suggests that this spread reduction is driven by the mitigation of shareholder-creditor agency conflicts. Buchner et al. (2022) find that debt funds grant interest rebates for loans financing deals of their affiliated PE firms. Peristiani and Santos (2019) discover that CLOs sell loans arranged by

affiliated banks before the onset of defaults. This effect can be attributed to a combination of a generally increased risk-sensitivity of bank-affiliated CLOs and private information spillover in the case of loans arranged by the affiliated bank.

In addition, this paper is related to existing studies on the portfolio preferences and trading behavior of CLOs. Benmelech et al. (2012) show that CLOs are more likely to purchase loan facilities that are larger and used to fund leveraged buyouts (LBOs). Loumioti and Vasvari (2019) identify two forms of strategic trading used to avoid failing overcollateralization tests. The first one incorporates selling facilities at prices above par and retaining loans valued below par. The second involves using other CLOs of the same manager as trading partners. Mählmann (2022) finds that CLOs use their closed-end structure to increase their secondary market purchase volume in periods of fire sales triggered by mutual loan fund redemptions.

Our investigation of the funding support hypothesis contributes to the literature on the role of CLOs in the funding of leveraged loans. Nadauld and Weisbach (2012) find that CLO investment reduces the spread of a loan facility. Shivdasani and Wang (2011) show that banks that are highly active in CLO underwriting arrange more LBO loans. Moreover, their LBO loans have lower spreads and looser covenants in comparison to those arranged by other banks. Ivashina and Sun (2011), who observe an inverse relationship between institutional demand pressure and loan spreads, find that this effect is especially pronounced in facilities bought by CLOs.

Finally, our examination of the preferential allocation hypothesis adds to the literature on primary market allocations. Benveniste and Spindt (1989) posit that IPO underwriters allocate underpriced shares to investors with the objective of incentivizing the revelation of private information regarding the stock value. Loughran and Ritter (2002) argue that underwriters use preferential allocations to investors as a reward mechanism for revenue generation and as an incentive for the continuation of a close business relationship. Consistent with these hypotheses, we find evidence that loan arrangers provide preferential allocations to CLO managers affiliated with the issuers' PE sponsors as compensation for information revelation and revenue generation. While Jenkinson et al. (2018) and Nikolova et al. (2020) observe similar effects in the primary equity and bond markets, to the best of our knowledge, we are the first to investigate

preferential allocations in the leveraged loan market. The closest related paper in this market segment was published by Bruche et al. (2020) who find that leveraged loan arrangers use underpricing and rationing as mechanisms to incentivize the revelation of private information about a new loan issuance.

The remainder of this paper is structured as follows: Section III.2 provides a detailed overview of our data sources and the methodology used to identify affiliated investments. Section III.3 entails the empirical analysis of the existence and magnitude of the affiliated investment bias. In Section III.4, we examine potential mechanisms behind the bias before providing a concluding summary in Section III.5.

III.2 Data

III.2.1 Data sources

CLOs are securities backed by typically 200-400[2] individual corporate loans. Since CLOs primarily invest in loans with non-investment grade ratings, their portfolios contain similar assets to those held by leveraged loan mutual funds. However, from the investor's perspective, they are more illiquid due to their closed-end structure, which enables them to buy loans during periods of fire sales induced by loan fund redemptions (Mählmann, 2022). Moreover, CLOs don't directly pass on the cash flows of their portfolio loans to the investors. Instead, a special purpose vehicle (SPV) generates different security tranches with increasing risk and interest rates as the seniority decreases. This structure results from the waterfall principle defined during the securitization process, by which each tranche is only paid after the claims of all more senior tranches have been satisfied in full (Martin and Sayrak, 2022). Holding about half of the outstanding institutional leveraged loan volume by the end of 2018, CLOs have been the largest group of non-bank leveraged loan investors in recent years (Financial Stability Board, 2019).

We obtain our CLO data from Creditflux's CLO-i database. CLO-i provides data on CLO

[2] According to Kundu (2023) the 25th (75th) percentile CLO holds 181 (407) loans.

trades and portfolio holdings, which Creditflux gathers from the CLOs monthly trustee reports.[3] CLO-i started its broad coverage of CLO data in 2008 (Bozanic et al., 2018). In addition, a small number of CLO managers provided historical trustee reports for their active CLOs, resulting in a very limited dataset on CLO portfolios from 2003-2007. However, data from the years prior to 2008 account for only approximately 2% of our trade and holding datasets, with the remaining 98% covering the period from 2008-2015. Due to its comprehensive coverage, CLO-i has been used in a number of CLO-related empirical studies (e.g. Benmelech et al., 2012, Liebscher and Mählmann, 2017, Loumioti and Vasvari, 2019, Elkamhi and Nozawa, 2022, Kundu, 2024).

In order to classify a CLO's loan investment as (un)affiliated, we require information on the PE sponsor(s) of the borrowing company. Unfortunately, CLO-i doesn't provide this information. Thus, we rely on the DealScan database to determine the PE sponsors of the companies in the loan portfolios of the CLOs. DealScan provides comprehensive information on newly issued loans, including the name of the borrower's PE sponsor(s) at the time of issuance.[4] We use this data to generate a list of all PE sponsors for each company, including the time range of their sponsoring relationship. For each company-PE firm combination, we define the date of the first loan issuance listing the PE firm as sponsor as starting point for the sponsoring relationship. To determine the end of the relationship, we use the maturity date of the company's last facility listing or the issuance date of the company's first facility not listing the PE firm as sponsor, whichever occurs first. We use a combination of manual and algorithmic renaming to align the company names in CLO-i with those used in DealScan. This enables us to match the datasets and add the sponsoring information to our loan portfolio data.

III.2.2 Affiliation status

The classification of a portfolio loan as an (un)affiliated investment is determined by the affiliation status between the CLO holding and the company issuing the loan. This CLO-company-

[3] Trustees act as custodians of the CLOs' assets and oversee their compliance with the covenants. In addition, they represent the interests of the investors in a fiduciary capacity and ensure transparency through their reports (Kundu, 2023).

[4] Of all PE-sponsored facilities in the DealScan database, approximately 84% are sponsored by one and 16% by two or more different PE firms. For the subset of facilities that are bought by at least one CLO, the proportions are 76% (one sponsor) and 24% (two or more sponsors).

specific dummy variable is based on the corporate relation between the CLO manager and the company's sponsor(s). More specifically, for the investment to be categorized as affiliated, the CLO manager must be part of the same group as a sponsor of the company. Table III.1 illustrates the determination of the affiliation status for three exemplary CLOs and portfolio companies with their corresponding managers and sponsoring PE firms during the second quarter of 2015. Using the combination between Avery Point II CLO and Atento SA as example, the CLO was managed by Sankaty Advisors, which was Bain Capital's debt arm in 2015. One of Atento SAs two sponsoring PE firms was Bain Capital Private Equity. Thus, both the observed CLO and company were part of the group Bain Capital, resulting in an *Affiliation* dummy of one.

Determining the group name of a PE sponsor is relatively simple. In most cases, the entire group has emerged from the PE firm in the first place. Thus, the two entities are usually named identically or very similarly and DealScan uses the group name for the PE firm. However, it is often more difficult to determine the group affiliations of the CLO managers. As PE-affiliated asset management groups frequently establish or expand their debt business through takeovers, the names of the CLO managers are often unrelated to the group name. Moreover, due to the CLO manager takeovers, many CLOs in our sample exhibit a change in their group affiliation over the course of their life cycle. Thus, we use information from Fitch Ratings (2014), CLO manager websites and CLO prospectuses to identify the group names of the CLO managers and any changes in these affiliations over time.

Besides the CLO manager takeovers, there is a second type of event that can trigger a change in the affiliation status of a CLO-company combination. When a PE firm sells or acquires a company, the sponsor of this company changes along with the group. This would result in a different affiliation status for the company with potential CLOs of the debt arms of the groups behind the old and new sponsoring PE firm. As described above, we account for these changes by considering the time range of each sponsoring relationship. Due to the time-varying nature of the affiliation status we determine the *Affiliation* dummy separately for each temporal observation point of a CLO-company combination in our dataset. For example, in section III.3.1 we observe affiliated investments in quarterly CLO portfolios. Therefore, we

Table III.1: This table illustrates the generation of the *Affiliation* variable. Each of the three columns represents a company that issued at least one loan that was part of a CLO portfolio in our dataset. Besides the company's name, the table includes information on its sponsor(s) during the second quarter of 2015, as well as each sponsor's group. Every row represents a CLO, with the table containing information on the CLO manager and the manager's group affiliation during the same quarter. Each cell shows the affiliation status of the combination between the company in its column and the CLO in its row. The affiliation dummy is one if the group of one of the sponsoring PE firms is identical to the group of the CLO manager and zero otherwise.

Company			**Atento SA**		**Ipreo LLC**		**Pets at Home**
Sponsor(s)			Bain Capital Private Equity	Gávea Investimentos	Goldman Sachs Asset Management	Blackstone Group	KKR & Co
Group(s)			Bain Capital	JP Morgan Chase	Goldman Sachs	Blackstone Group	KKR & Co
Avery Point II CLO	Sankaty Advisors	Bain Capital	Affiliation: 1		Affiliation: 0		Affiliation: 0
Apidos X	CVC Credit Partners	CVC Capital Partners	Affiliation: 0		Affiliation: 0		Affiliation: 0
Pinnacle Park CLO	GSO Capital Partners	Blackstone Group	Affiliation: 0		Affiliation: 1		Affiliation: 0
CLO	CLO Manager	Group					

evaluate the affiliation status separately for each occurring CLO quarter-company combination.

Determining the affiliation status of a CLO-company combination only makes sense if the CLO manager belongs to a group that also runs a PE firm and if one of the company's PE sponsors is part of a group that is active in the CLO business. Table III.2 provides an overview of the share of companies and CLO quarters that meet these requirements. In approximately 71% of all 16,308 quarterly CLO portfolio observations, the CLO manager is PE-affiliated. This high proportion underpins the important role of PE firm running asset management groups in the CLO business. In total, our sample includes 6,255 different companies that appear as borrowers in at least one of the observed CLO portfolios. According to our DealScan data, about 47% of these companies are at least temporarily sponsored by a PE firm. Among these PE-sponsored companies, 43% have one or more sponsors whose group also runs a CLO manager appearing in our CLO-i dataset. Thus, approximately one-fifth of the observed companies are potentially affiliated with some of the CLOs in our sample.

Table III.2: This table presents summary statistics for our CLO-i dataset of CLOs and their portfolio holdings. The left side of the table contains information on the number of CLOs and CLO quarters, as well as the subset of CLO quarters with PE-affiliated managers. The right side of the table shows the number of CLO portfolio companies from our entire dataset, as well as the subsample that is (at least temporarily) sponsored by a PE firm according to DealScan. Moreover, the table contains information on the fraction of PE-sponsored companies where at least one sponsor belongs to a group that is also involved in the CLO business. Italic text indicates that all observations are a subset of the sample described in the row above and the proportion included in this subset is presented next to its number of observations.

CLO Manager-Data	N	Share	CLO Portfolio-Data	N	Share
CLOs	1193		Companies	6255	
CLO Quarters	16308		*PE-sponsored*	2914	0.466
with PE-aff. Managers	11538	0.708	*by CLO-aff. Sponsors*	1249	0.429

III.3 Affiliated investment bias of CLO managers

III.3.1 Benchmark portfolio approach

We now address our first research question: Do PE-affiliated CLO managers exhibit a bias towards affiliated loan investments? As a starting point, we calculate the proportion of affiliated holdings in the quarterly portfolios of CLOs run by managers that are part of asset management

groups that also operate PE firms. This figure is then compared to that of a benchmark portfolio. However, in contrast to mutual funds, CLOs do not "trade against" a prespecified benchmark. Thus, for each "treatment" CLO i in quarter q we use the same quarter's portfolio holdings of a matched CLO j but run by a manager belonging to a different group as benchmark. As the bulk of investments takes place around the issuance of the CLO, the benchmark portfolio also has to consist of loans available at that time. Therfore, we restrict the universe of matchable portfolios to CLOs with the same issuance year as the treatment observation.

Among these CLOs, we base the selection of the control portfolio on three variables. The first one is the portfolio size measured by the par value of all assets. The second is the share of assets denominated in USD. Finally, we use the par value-weighted average of the rating-implied PDs of the portfolio loans. We normalize all three variables on a scale from 0 to 1 and then choose the portfolio with the lowest Euclidean distance $d_{i,j,q}$ as control. For CLO i in quarter q that is the CLO j, that minimizes the following function:

$$d_{i,j,q} = ((\text{Portfolio Size}_{i,q}^{norm} - \text{Portfolio Size}_{j,q}^{norm})^2 + (\text{USD Share}_{i,q}^{norm} - \text{USD Share}_{j,q}^{norm})^2 + (\text{Average PD}_{i,q}^{norm} - \text{Average PD}_{j,q}^{norm})^2)^{\frac{1}{2}} \quad (1)$$

To prevent the differences between the CLO quarters from becoming too large, we restrict the Euclidean distance to a maximum of 0.1 and drop all observations without a matchable CLO quarter fulfilling this requirement. Of our 11,538 quarterly CLO portfolios with PE-affiliated managers, we end up with 7,794 treatment quarters. Table III.3 presents descriptive statistics for these portfolios as well as their matched benchmark observations that we use to analyze whether there is a bias towards affiliated investments among CLO managers. The statistically insignificant difference between the means of all three variables, as well as the comparison of the medians and standard deviations, suggest a high degree of similarity between the treatment CLOs and their matched controls.

After describing the matching procedure, we introduce the measurement we use to estimate the affiliated investment bias at the CLO portfolio level - the *Affiliated Investment Overweight*

Table III.3: This table presents summary statistics for the quarterly holdings of a sample of CLOs run by managers who are part of PE firm operating groups. Each of these treatment CLO quarters is matched with a control CLO portfolio of the same quarter, operated by a manager belonging to a different group. The matched CLO has to be issued in the same year as the treatment CLO. From these CLOs the one with the lowest Euclidean distance to the treatment CLO during the quarter of observation is selected as control. The Euclidean distance is based on the following three normalized variables referring to the portfolio holdings: *Portfolio Size*, *USD Share* and *Average PD*. For a CLO to be matchable, we require the Euclidean distance to be smaller than 0.1 (caliper matching). The p-value refers to the difference of means between the treatment and control observations.

	Treatment				Control				
	N	mean	sd	median	N	mean	sd	median	p-vaule
Portfolio Size	7794	390.573	192.183	384.968	7794	386.632	184.847	383.479	0.192
USD Share	7794	0.690	0.457	1.000	7794	0.689	0.459	1.000	0.916
Average PD	7794	8.331	5.293	7.109	7794	8.218	5.117	7.089	0.176

(AIO). The AIO is the difference between the par value-weighted fraction of affiliated investments in a treatment CLO portfolio and the fraction of loans in the corresponding control portfolio that would qualify as affiliated investments for the treatment CLO (hereafter *pseudo-affiliated*). The AIO calculation can be described by the following formula, where the index variable k (l) represents the n (m) individual portfolio holdings in the treatment (control) portfolio:

$$\text{AIO}_{i,q} = \frac{\sum_{k=1}^{n} \text{Par Value}_{i,k,q} * \text{Affiliation}_{i,k,q}}{\text{Portfolio Size}_{i,q}} - \frac{\sum_{l=1}^{m} \text{Par Value}_{j,l,q} * \text{Affiliation}_{i,l,q}}{\text{Portfolio Size}_{j,q}} \quad (2)$$

[5]

Panel A of Table III.4 illustrates the distribution parameters for the AIO in the 7.794 observed CLO quarters. On average, affiliated investments account for a fraction of 3.4% of the treatment CLO portfolios. This is equivalent to an AIO of 1.8 percentage points in comparison to the matched control portfolios serving as benchmark. The AIO is positive for 49% and negative for 16% of observations leaving the median value at zero. The main reason for the high number of observations with an AIO of zero is the absence of any (pseudo-)affiliated investment in both the treatment and control portfolio for a substantial fraction of CLO quarters.

Although all CLOs in our sample are PE-affiliated, there may be periods without any investable loans to portfolio companies of the affiliated PE firm, which would inevitably result

[5]Note that the affiliation status doesn't refer to the combination of portfolio loan l and control CLO j, but to the combination of portfolio loan l and treatment CLO i.

in an AIO of zero. Therefore, in Panel B, we determine the AIO distribution for the subset of observations with at least one (pseudo-)affiliated holding in either the treatment or control portfolio. Consequently, the share of affiliated investments increases in Panel B, reaching 5.2%, which is equivalent to an AIO of 2.7 percentage points over the proportionally increased benchmark. In Panel B, about three quarters of the observations have a positive and one quarter has a negative AIO.

Table III.4: This table presents parameters for the distribution of the AIO in our sample of quarterly CLO portfolios. The AIO is calculated as the difference between the par value-weighted proportion of affiliated investments in an observed treatment CLO and the fraction of its matched control portfolio that would qualify as affiliated investments for the observed treatment CLO (pseudo-affiliation). Below the AIO, we also report distribution parameters for the share of (pseudo-)affiliated investments in both, the treatment (*Affiliated Investments*) and control (*Benchmark*) portfolios. Panel A includes all CLO quarters with matched controls, while Panel B includes only those with at least one (pseudo-)affiliated investment in the treatment or control portfolio. The p-value refers to the statistical significance of the difference between the mean AIO and zero, which is identical to the p-value of a paired t-test on the mean differences between the share of (pseudo-)affiliated investments in the treatment and control portfolios.

	N	mean	sd	p10	p25	p50	p75	p90	p-value
Panel A: No Restriction									
AIO	7794	0.018	0.042	-0.007	0.000	0.000	0.024	0.069	0.000
Affiliated Investments	7794	0.034	0.055	0.000	0.000	0.009	0.043	0.113	
Benchmark	7794	0.016	0.025	0.000	0.000	0.000	0.025	0.053	
Panel B: Affiliated Investments > 0 or Benchmark > 0									
AIO	5109	0.027	0.049	-0.013	0.000	0.015	0.041	0.087	0.000
Affiliated Investments	5109	0.052	0.060	0.000	0.010	0.029	0.078	0.135	
Benchmark	5109	0.024	0.028	0.000	0.000	0.015	0.039	0.062	

In relative terms, the AIO is equivalent to overweighting affiliated loans by a factor of approximately 2.1, indicating a high bias towards these investments in PE-affiliated CLOs. Most existing studies on biases for affiliated investments incorporate mutual funds run by asset management divisions of banking groups. In a sample of bank-affiliated mutual funds, Ferreira et al. (2018) find an average overweighting of stocks from the parent banks' borrowers of 5.9 percentage points. This corresponds to an approximately 1.7 times higher portfolio share in comparison to passive funds with a similar investment universe. While we measure the portfolio weights of debt investments where the borrowing company is part of an affiliated equity portfolio, Ferreira et al. (2018) go in the opposite direction and analyze the fraction of equity holdings of companies that are affiliated via a credit contract.

To the best of our knowledge, the only other paper analyzing the bias in affiliated debt investing is from Gil-Bazo et al. (2020). However, instead of portfolio holdings, they focus on bond issuances by the parent banks of Spanish mutual funds. Using a regression framework, they find that affiliation to the issuance bank increases the cumulative primary market purchase volume on the asset management group level by 2.85% of the bond's total issuance volume. Due to the different setting and the lack of information on the average purchase volume, it is difficult to compare their and our results regarding the magnitude of the effect.

In addition to assets issued by a fund's parent bank or their borrowers, an affiliation effect on the portfolio selection was also observed with regard to underwriting clients of the bank. In a sample of bank-affiliated mutual funds, Hao and Yan (2012) find that the fraction of stocks from companies that are initial public offering (IPO) or seasoned equity offering (SEO) clients of the parent bank is on average approximately twice as high (3.99% vs 1.94%) as the portfolio weights of the same companies in unaffiliated funds. Similarly, in a study by Zheng and Yan (2021), the probability of holding stocks of a bank's IPO/SEO client was twice as high (14.7% vs. 7.2%) for a sample of hedge funds affiliated with the bank in comparison to unaffiliated hedge funds. The settings of the other studies differ from ours in several ways. Unlike us, the other studies all incorporate investment vehicles from public companies, primarily focus on equity investments and partially refer to underwriting clients. Yet, it is interesting that the "bias factor" of 2.1 that we observe in our sample of PE firm-affiliated CLOs is in a similar order of magnitude to that discovered in some of the studies on bank-affiliated funds.

As Table III.4 shows, there is considerable variation in the AIO across different CLOs. In the subset with at least one (pseudo-)affiliated holding in the treatment or control portfolio in Panel B, the AIO differs by 10 percentage points between the 10th (-1.3 percentage points) and the 90th (8.7 percentage points) percentile. This leads us to the question of the driving factors behind these differences. An obvious factor that should influence the level of AIO is the size of the affiliated PE business. The larger a PE firm's portfolio, the more affiliated investment opportunities exist for a CLO manager of the same group as the PE firm, increasing the possibility to materialize a bias towards affiliated investments. We assume that the share of pseudo-affiliated investments in the benchmark portfolio is indicative of the business volume

of the treatment CLO manager's affiliated PE firm. This assumption is based on the idea that loans to a subset of companies will account for a higher proportion of an unbiased debt portfolio if this subset consists of more and larger companies. Thus, in order to examine the presumed relation between the AIO and the size of the affiliated PE portfolio, we regress the AIO on the share of pseudo-affiliated investments in the matched control portfolio (*Benchmark*).

Table III.5 shows the resulting coefficient estimates from that regression. Unsurprisingly, the coefficient estimates are positive, indicating an increase of the AIO by 0.5 percentage points for each percentage point increase of the *Benchmark* for the entire sample. In other words, any change in the fraction of pseudo-affiliated investments in the control portfolio is associated with a 1.5-fold change in the treatment portfolio's share of affiliated investments. When we exclude observations with zeros for the (pseudo-)affiliated investments in both portfolios (Panel B), this factor decreases to approximately 1.33.

Table III.5: This table presents coefficient estimates for the regression of the AIO on different CLO specific variables. *Benchmark* refers to the fraction of pseudo-affiliated investments in the CLO quarters matched control portfolio. *Portfolio Size* is the inflation-adjusted par value of all assets held by the CLO. *USD Share* is the fraction of assets denominated in USD. *Average PD* is the par value-weighted average of the rating-implied PDs of the portfolio loans. Panel A includes all CLO quarters with matched controls, while Panel B includes only those with at least one (pseudo-)affiliated investment in the treatment or control portfolio. Standard errors are clustered at the CLO level with the corresponding p-value reported in parentheses.

	Panel A		Panel B	
	(1)	(2)	(3)	(4)
Benchmark	0.500	0.503	0.332	0.341
	(0.000)	(0.000)	(0.001)	(0.001)
Portfolio Size		0.000		0.000
		(0.462)		(0.904)
USD Share		-0.008		-0.010
		(0.031)		(0.072)
Average PD		0.000		0.002
		(0.201)		(0.073)
Quarter FE	Yes	Yes	Yes	Yes
N	7794	7794	5109	5109
adj. R^2	0.090	0.100	0.034	0.066

In Columns (2) and (4), we added the three CLO specific variables we have used for the matching process to the regression equation. Prior to the analysis, there was no obvious hypothesis regarding the relation between the AIO and these three variables. While the regression

results provide no evidence for a relation between CLO size and AIO, the *USD Share* coefficients indicate a slightly lower AIO in US CLOs. The estimate for the *Average PD* coefficient differs between the samples in Panel A and B. Unlike for the entire sample, the results for the subset with at least one (pseudo)-affiliated investment in one of the CLO portfolios provide some indication of a slightly higher AIO in riskier portfolios.

III.3.2 Potential Dyads approach

While the benchmark portfolio approach is well established in the field of financial economics, especially in research studying geographic preferences of investors (e.g., Coval and Moskowitz, 1999; Ivković and Weisbenner, 2005), it neglects potential alternatives available to investors at the time of their investment decision. This weakness of the portfolio approach might lead to an underestimation of the affiliated investment bias for periods when there are no affiliated facilities available on the market. To address this issue we apply an alternative potential dyads approach (Lin and Viswanathan, 2016) where we identify all possible pair-wise combinations between CLOs purchasing at least one loan facility and loan facilities purchased by at least one CLO for every month in our dataset.

More specifically, we build the sample for this analysis by extracting all purchases of loans to PE-sponsored companies carried out by PE-affiliated CLOs from our trading data. We ignore any purchases that include loans to non-PE sponsored companies or CLOs that aren't part of a group operating a PE firm, as these purchases can't be affiliated investments. Based on this sample, we build a list of all CLOs buying at least one loan to a PE-sponsored company in each observation month. Simultaneously, we generate a list of all sponsored facilities that were purchased by at least one PE-affiliated CLO in the same month, representing the set of loans available to investors. Then, we merge these lists and generate a unique observation for each CLO-facility-month combination. We subsequently define a dummy variable *Realized Purchase* taking the value one if the CLO has purchased and zero if it has refrained from buying the loan facility in the observed trading month. Table III.6 illustrates the generation of the potential dyads dataset from the trading data for a simplified example month.

In order to detect a possible affiliated investment bias, we determine the affiliation status

Table III.6: This is a simplified example for the generation of the potential dyads dataset. Subtable A shows the trading data from CLO-i in an example month. Subtable B shows the *Realized Purchase* dummy for each of the resulting observations in the regression data set.

A: Trading data example month

CLO	Facility	Type
A	1	Purchase
A	3	Purchase
C	3	Purchase
D	1	Sale
D	4	Sale
D	5	Purchase

B: Potential dyads dataset example month

CLO	Facility	Realized Purchase
A	1	1
A	3	1
A	5	0
C	1	0
C	3	1
C	5	0
D	1	0
D	3	0
D	5	1

between the borrowing company and the (potentially) purchasing CLO as described in section III.2.2 for the corresponding trading month of each observation in the potential dyads dataset. We then regress *Affiliation* on the Realized Purchase dummy. A positive *Affiliation* coefficient would imply, that the odds of actually realizing a possible purchase of a loan facility are higher if the CLO manager belongs to the same group as a PE firm sponsoring the borrowing company.

We control for important CLO-related characteristics potentially influencing the purchase decision. Since a larger CLO has to buy more loans to realize the same portfolio turnover rate as a small CLO, the purchase probability should increase with the CLO portfolio size. In addition, the ability to buy new loans is strongly tied to a CLO's life cycle. There are three different phases with regard to the balance sheet development of a CLO. First, in its ramp-up period, until reaching the effective date, a CLO increases its balance sheet to the target portfolio size. In the following reinvestment period, the portfolio size remains at a similar level, limiting the net purchase volume roughly to the amount of maturing loans. Finally, the CLO enters the amortization period where purchases are heavily restricted (Kundu, 2023). By adding dummy

variables for the ramp up- and reinvestment period, we take the influence of the CLO life cycle on the purchase decision into account.

To control for the facility attractiveness we use the rating-implied PD as well as the excess spread over the average facility with the same rating letter traded in the same month. The vast majority of purchased loans are denominated in the same currency as the buying CLO. Thus, we add a dummy variable, indicating whether the CLO and facility currency in a potential purchase are identical. Loumioti and Vasvari (2019) discover, that within-CLO manager trading is a commonly used measurement to avoid the expensive failure of overcollateralization tests. Motivated by this finding, we include a dummy variable indicating a sale of the facility by another CLO of the same manager in the observation month. To control for the overall debt market conditions, we follow Axelson et al. (2013) and use the high-yield bond spread over LIBOR as a measurement of the risk-premium in the non-investment grade market segment.

Table III.7 shows the coefficient estimators for the potential dyads regression. For statistical inference we follow Abadie et al. (2023) and cluster the standard errors on the level of "treatment assignment". In our case, this means the level of the *Affiliation* dummy, which is determined by the combination of the CLO manager and the PE sponsor of the facility's borrowing company, both of which are recorded at the group level.[6] In Column (1), the coefficient of *Affiliation* is 0.079, which is 35% of the unconditional purchase probability. This result suggests a strong affiliated investment bias in the purchase decisions of CLO managers.

With regard to the control variables, the *Log(Portfolio Size)*, *Same Currency* and *Affiliated Sale* coefficients have the expected signs. While this is also true for the *Ramp-up* and *Reinvestment Period* dummies, it is at first glance surprising that the purchase probability hardly differs between these two periods. However, this result likely reflects the findings of Shivdasani and Wang (2011), that the business of PE firms is heavily related to CLO issuance. The high volume of financing activity during periods of increased CLO issuance seems to absorb the effect of higher net purchases, resulting in a similar probability of realizing a potential purchase during the ramp-up and reinvestment period. The coefficients on the spread and risk parameters

[6]For example, the *Affiliation* dummy equals one for all potential purchases with the CLO manager-PE sponsor combination "Blackstone Group, Blackstone Group" and zero for all observations in the cluster "Blackstone Group, KKR".

Table III.7: This table presents regression results from the potential dyads approach. The observations are the monthly combinations from the list of PE-affiliated CLOs buying at least one sponsored loan and sponsored loans purchased by at least one PE-affiliated CLO. We construct a dummy that is one if the CLO bought the facility in the observation month. This variable (*Realized Purchase*) is used as dependent variable in all columns. The *Affiliation* dummy takes the value one if the CLO manager is affiliated with one of the borrowing company's sponsors and zero otherwise. All control variables are explained in appendix Table III.A.1. The constant is estimated but not reported. Standard errors are clustered at the CLO manager-sponsor level with the corresponding p-values reported in parentheses.

	(1)	(2)	(3)	(4)	(5)
Affiliation	0.0079	0.0069	0.0074	0.0071	0.0178
	(0.018)	(0.072)	(0.034)	(0.026)	(0.049)
Log(Portfolio Size)$_{t-1}$	0.0050	0.0043		0.0055	0.0038
	(0.000)	(0.000)		(0.000)	(0.146)
Ramp-up Period	0.0131	0.0127		0.0145	0.0264
	(0.000)	(0.000)		(0.000)	(0.000)
Reinvestment Period	0.0133	0.0145		0.0115	0.0186
	(0.000)	(0.000)		(0.000)	(0.000)
Rating adjusted Spread	0.0004	0.0017	0.0018		0.0021
	(0.008)	(0.000)	(0.000)		(0.000)
PD	-0.0003	-0.0003	-0.0003		0.0000
	(0.000)	(0.000)	(0.000)		(0.859)
Same Currency	0.0249	0.0247	0.0303	0.0323	
	(0.000)	(0.000)	(0.000)	(0.000)	
Affiliated Sale	0.0264	0.0224	0.0191	0.0243	-0.0030
	(0.000)	(0.000)	(0.000)	(0.000)	(0.369)
HY bond spread over LIBOR	0.0007	0.0005			-0.0004
	(0.000)	(0.003)			(0.140)
Log(# Syndicate Members)		0.0021	0.0019		
		(0.001)	(0.001)		
Log(Facility Amt)		0.0028	0.0026		
		(0.000)	(0.000)		
LBO/SBO		0.0009	0.0011		
		(0.150)	(0.082)		
Secured		-0.0010	-0.0024		
		(0.514)	(0.108)		
Performance Pricing		-0.0005	-0.0014		
		(0.536)	(0.087)		
Loan Type FE	Yes	Yes	Yes	No	No
CLO-Month FE	No	No	Yes	No	No
Facility-Month FE	No	No	No	Yes	No
CLO-Facility FE	No	No	No	No	Yes
N	2,131,375	1,239,969	1,723,429	2,195,221	2,131,375
Adj. R^2	0.0067	0.0067	0.0281	0.0401	0.1548
Uncond. Probability	2.27%	2.32%	2.33%	2.24%	2.27%

suggest a reaching for yield behavior that has already been discovered in the corporate bond market for investment decisions by mutual funds (Choi and Kronlund, 2018) and insurance companies (Becker and Ivashina, 2015). The bond spread coefficient indicates opportunistic purchases in times of elevated risk premiums.

In Column (2), we have matched our regression dataset to the DealScan facility database, which allows for the inclusion of additional loan parameters. To determine the affiliation status, it was sufficient to align the company names from the CLO-i database with those of the DealScan database. However, there are often multiple loan facilities from the same company in both databases. Therefore, we needed to identify the corresponding DealScan facility for each loan from CLO-i in order to add the additional variables to the dataset. Due to the lack of a common unique identifier, we used the algorithm described in the appendix of Geburtig et al. (2025) to match loan facilities from the two databases. This matching procedure is based on the trade date, interest rate and security name variables from CLO-i, the issuance date, spread and seniority variables from DealScan and the loan type and maturity date variables from both datasets.

As we weren't able to uniquely assign every facility of CLO-i to a corresponding facility in DealScan, the additional control variables come at the cost of a reduced sample size. The estimator of the *Affiliation* dummy slightly decreases to 0.0069 (30% of the unconditional purchase probability). However, the interpretation of an economically meaningful affiliated investment bias remains unchanged. As expected, the size of both, the facility amount and the lending syndicate, is positively related to the odds of being bought. The other additional facility parameters show no statistically significant connection to the *Realized Purchase* dummy.

As a result of the research design, the likelihood of the *Realized Purchase* dummy assuming the value of one strongly depends on the CLO-month and facility-month combination. In our simplified example month in Table III.6, the purchase probability for a random loan is, unconditional to other variables, two thirds if the potential buyer is CLO A and one third for CLOs C and D. Considering only the potentially bought facility, the realization probability is two thirds for facility 3 and one third for facilities 1 and 5. We take this specific feature of the potential dyads approach into account, by adding clo-month fixed effect in Column (3) and

facility-month fixed effects in Column (4).

In these models, all variables on the month and CLO-month level (Column (3)), respectively the facility, month and facility-month level (Column (4)) are omitted due to perfect collinearity. This leads to an increase in the number of observations as some of the omitted variables haven't been available for all CLO-months or facilities. In both models, the *Affiliation* coefficient falls between the estimates of Column (1) and (2), largely confirming the implied bias. Controlling for the CLO-month, there is also an indication of a slight preference for LBO-financing loan facilities, a result in line with the findings of Benmelech et al. (2012).

In the models in Column (1) to (4), we assume that all purchased loans are available investments for all CLOs that buy other loans in the same month. However, this assumption neglects potential CLO-facility specific characteristics that may prevent a CLO from purchasing the loan. We control for the most obvious of these factors by implementing the *Same Currency* dummy, since investing in loans denominated in a different currency than the CLO notes would impose a considerable exchange rate risk to the CLO portfolio. However, it is easy to imagine many more of these factors, such as the relationship between the maturity and risk level of the CLO note and the loan facility, as well as CLO covenants or other investment restrictions.

We account for the fact that it is almost impossible to consider all these factors and that some of them would be difficult to measure by implementing fixed effects. The use of CLO-facility-month fixed effects is not feasible, as each of these combinations has only one observation and therefore a variance of zero for the *Realized Purchase* and *Affiliation* dummies. However, as described in section III.2.2, there are two scenarios in which the affiliation status of a CLO-company combination changes over time: Acquisitions of companies by PE firms and CLO manager takeovers by PE-affiliated groups. If one of these scenarios occurs between two different months in which a CLO-loan facility combination appears in our dataset, the affiliation status may be different in each of the two observations. Thus, in Column (5), we use CLO-facility fixed effects to control for unobserved factors at this level that might prevent CLOs from purchasing the loan. While this allows us to fully control only for time-invariant variables, the fixed effects also partially adjust the model for unobserved factors that vary primarily at the CLO-facility level and little over time.

The implementation of CLO-facility fixed effects results in an approximate 2.5-fold increase of the *Affiliation* coefficient to 0.0178 or 78% of the unconditional purchase probability. This finding provides strong evidence that the models in Columns (1) to (4) underestimate the magnitude of the affiliated investment bias. The most likely reason for this is that our regression model includes loans as investable facilities, which, although purchased by some CLOs, are difficult or impossible to buy for other CLOs. In cases where the issuing companies are affiliated with the manager of a CLO that is unable to invest in the loan, there is no possibility for the CLO manager to materialize a potential bias towards affiliated investments. This interpretation of the results comes with the slight caveat of larger confidence intervals due to the fact that the majority of CLO-facility combinations exhibit no change in affiliation status throughout their lifetime. However, given the considerably larger size of the coefficient, the estimator is still statistically significantly different from zero.

Overall, the potential dyads approach provides evidence of a strong affiliation bias in the investment decisions of PE-affiliated CLOs. Models without CLO-facility fixed effects indicate that the odds that a CLO will buy a loan facility increase by about one third of the unconditional purchase probability if the CLO manager is affiliated with the borrowing company of the loan. The model with CLO-facility fixed effects suggests an even stronger bias, as the other models may underestimate the effect by including investable loans that are in fact difficult for some CLOs to purchase.

III.4 Mechanisms behind the affiliated investment bias

III.4.1 Investment strategy based mechanism

Having established the existence of an affiliated investment bias for CLO managers, we now turn to our second research question: What causes the bias towards affiliated loan investments? The most obvious explanation is that asset management groups frequently incorporate cross-divisional investment strategies in their debt and equity arms. As a result, the group's PE firm and CLO manager may have similar preferences for a number of company specific characteristics. Under this similar preferences hypothesis, there would be no causal relationship between CLO

lending and the sponsoring of an affiliated PE firm. The affiliation bias would rather result from coinciding investment decisions from different sub-divisions of the same group. One of many possible examples of this mechanism would be a group that has specific expertise in a particular industry. The group may use this expertise by overweighting the industry in both its PE firm's equity holdings and its CLO manager's loan investments. As a result, even if the individual investment decisions of a CLO manager were independent of its affiliated PE firm, the mere fact of coinciding industry preferences could result in an overweight of affiliated investments in the CLO manager's portfolio.

Since it is unlikely, that the company characteristic preferences significantly differ between primary and secondary market purchases of the same loan facility, we would expect a similar magnitude of the bias in both of these market segments if the similar preferences hypothesis holds true. To investigate potential differences between the segments, we repeat the potential dyads regression from Table III.7 and add a dummy variable *Primary Market* that takes the value one for purchases in the primary and zero for purchases in the secondary market.

The CLO-i trade dataset doesn't offer direct information on whether a trade was executed in the primary or secondary market. While DealScan provides a "completion date" variable, indicating the closing of the syndication process for about 15% of the loans facilities in our sample, we lack this information for the remaining 85%. As a pragmatic approach, we assume that all purchases with a trade date no earlier than 30 days before and no later than 30 days after the "FacilityStartDate" where carried out on the primary market. On the contrary, all purchases dated later than 30 days after the "FacilityStartDate" are classified as secondary market purchases. To mitigate the risk of errors in the date variable in one of the two datasets, we exclude observations with a trade date more than 30 days before "FacilityStartDate".

However, the potential dyads regression doesn't use single purchases as level of observation but instead the facility-month-CLO combination for all purchased facilities and all buying CLOs within a month. As a result, loan facilities bought by CLOs more than once within the same month may have both, realized purchases classified as primary and as secondary market purchase. This situation may occur if the 30-day limit for the primary market classification falls within the observation month. For these facility-month combinations, we set the *Primary*

Market dummy to one if at least one facility purchase within the month was realized within the 30-day primary market window.

Table III.8 shows the regression results for the potential dyads approach adding a *Primary Market* dummy as well as an interaction term between the *Affiliation* and the *Primary Market* dummy. In comparison to Table III.7 we lose about 23% of all observations in models without ((1), (4) and (5)) and 5% in models including ((2) and (3)) control variables from DealScan due to missing *Primary Market* dummies. This difference in the magnitude of sample size reduction is caused by the fact that we can't generate a *Primary Market* dummy for facilities without information on the issuance date from DealScan. As expected, the coefficient on the *Primary Market* dummy itself is positive, reflecting a higher number of different CLOs buying the same loan facility at issuance compared to an arbitrary month in which the facility is bought by at least one CLO on the secondary market.

More relevant for us are the *Affiliation* and *Affiliation*Primary Market* coefficients. The *Affiliation* estimators, which can be interpreted as affiliated investment bias in the secondary market, are much smaller than in Table III.7 and not statistically significantly different from zero. The coefficient on the interaction term with *Primary Market*, on the other hand, is between 2.69% (with CLO-month fixed effects) and 4.63% (with CLO-facility fixed effects), implying a much higher purchase probability in the primary market, if the CLO manager is affiliated with a PE sponsor of the issuing company.

It could be argued, that the size of the affiliated investment bias should be proportional to the unconditional purchase probability and thus higher for purchase decisions in the primary market. Comparing the fractions of all potential purchases that are actually executed, the "realization share" is 2.36 times higher (4.53% vs. 1.92%) for primary than for secondary market purchases. However, the bias increases, depending on the model, by a factor of between 4.57 (with CLO-facility fixed effects) and almost 55 (with facility-month fixed effects). This discrepancy underlines that the affiliated investment bias is highly concentrated in the primary market segment, arguing against similar preferences as the driving mechanism behind the phenomenon.

Table III.8: This table presents regression results from the potential dyads approach. The observations are the monthly combinations from the list of PE-affiliated CLOs buying at least one sponsored loan and sponsored loans purchased by at least one PE-affiliated CLO. We construct a dummy that is one if the CLO bought the facility in the observation month. This variable (*Realized Purchase*) is used as dependent variable in all columns. The *Affiliation* dummy takes the value one if the CLO manager is affiliated with one of the borrowing company's sponsors and zero otherwise. The *Primary Market* dummy takes the value one if the loan was purchased in the primary market and zero if it was bought in the secondary market. All control variables are explained in appendix Table III.A.1. The constant is estimated but not reported. Standard errors are clustered at the CLO manager-sponsor level with the corresponding p-values reported in parentheses.

	(1)	(2)	(3)	(4)	(5)
Affiliation	0.0024	0.0024	0.0039	0.0007	0.0116
	(0.273)	(0.349)	(0.143)	(0.763)	(0.288)
Primary Market	0.0274	0.0279	0.0269		0.0463
	(0.000)	(0.000)	(0.000)		(0.000)
Affiliation*Primary Market	0.0375	0.0390	0.0326	0.0377	0.0414
	(0.000)	(0.003)	(0.002)	(0.000)	(0.019)
Log(Portfolio Size)$_{t-1}$	0.0041	0.0040		0.0047	-0.0188
	(0.000)	(0.000)		(0.000)	(0.000)
Ramp-up Period	0.0130	0.0135		0.0138	0.0123
	(0.000)	(0.000)		(0.000)	(0.000)
Reinvestment Period	0.0132	0.0141		0.0118	0.0110
	(0.000)	(0.000)		(0.000)	(0.000)
Rating adjusted Spread	-0.0007	0.0003	0.0005		0.0022
	(0.000)	(0.244)	(0.019)		(0.000)
PD	-0.0004	-0.0003	-0.0002		-0.0002
	(0.000)	(0.000)	(0.000)		(0.135)
Same Currency	0.0255	0.0254	0.0302	0.0308	
	(0.000)	(0.000)	(0.000)	(0.000)	
Affiliated Sale	0.0234	0.0220	0.0189	0.0205	-0.0043
	(0.000)	(0.000)	(0.000)	(0.000)	(0.206)
HY bond spread over LIBOR	0.0011	0.0009			0.0002
	(0.000)	(0.000)			(0.494)
Log(# Syndicate Members)		0.0021	0.0018		
		(0.001)	(0.002)		
Log(Facility Amt)		0.0035	0.0033		
		(0.000)	(0.000)		
LBO/SBO		0.0012	0.0012		
		(0.065)	(0.048)		
Secured		-0.0012	-0.0022		
		(0.442)	(0.164)		
Performance Pricing		-0.0005	-0.0011		
		(0.536)	(0.188)		
Loan Type FE	Yes	Yes	Yes	No	No
CLO-Month FE	No	No	Yes	No	No
Facility-Month FE	No	No	No	Yes	No
CLO-Facility FE	No	No	No	No	Yes
N	1,653,933	1,179,223	1,643,260	1,689,808	1,653,933
Adj. R^2	0.0105	0.0111	0.0321	0.0401	0.1607
Uncond. Probability	2.31%	2.32%	2.33%	2.28%	2.31%

III.4.2 Affiliated funding bias

Before we evaluate other potential mechanisms behind the affiliated investment bias in section III.4.3, we introduce a new bias measurement for the primary market segment, namely the Affiliated Funding Bias (AFB). For the definition of primary market purchases we adhere to our time frame of trade dates between 30 days before and after the *FaciltiyStartDate*. To generate the AFB, we change the unit of observation to the loan facility. Then, for each facility i we calculate an *Affiliated Funding Share* by dividing the USD amount of all primary market purchases by CLOs with affiliation to the company's sponsoring PE firms by the total facility volume purchased by any CLO j in the primary market. Assuming n different CLOs purchase a loan facility in the primary market, its *Affiliated Funding Share* is defined in the following way:

$$\text{Affiliated Funding Share}_i = \frac{\sum_{j=1}^{n} \text{Primary market purchase volume}_{i,j} * \text{Affiliation}_{i,j}}{\sum_{j=1}^{n} \text{Primary market purchase volume}_{i,j}} \tag{3}$$

To estimate the AFB, we have to compare the actual to the expected *Affiliated Funding Share* under the assumption of no relation between the affiliation status of the CLO manager-PE sponsor combination and the purchase probability and volume of the newly issued loan. As proxy for this expected affiliated funding, we divide the purchase volume from all affiliated CLOs in facility issuance month m by the total monthly loan volume purchased by all CLOs in our dataset. In a month with p different CLOs buying at least one loan facility, this *Expected Affiliated Funding* share is calculated as follows:

$$\text{Expected Affiliated Funding}_i = \frac{\sum_{j=1}^{p} \text{Monthly purchase volume}_{j,m} * \text{Affiliation}_{i,j}}{\sum_{j=1}^{p} \text{Monthly purchase volume}_{j,m}} \tag{4}$$

[7]

Finally, we calculate the AFB by subtracting the *Expected Affiliated Funding* from the *Affilitaed Funding Share*:

[7]Note that the affiliation status doesn't refer to the combination of CLO j and the purchased loans, but to the combination of CLO j and observed facility i.

$$\text{AFB}_i = \text{Affiliated Funding Share}_i - \text{Expected Affiliated Funding}_i \tag{5}$$

Table III.9 presents summary statistics for the AFB and its related variables. In order to be included in the analysis, the *Expected Affiliated Funding* of a loan facility has to be larger than zero. That means that, in the month of loan issuance one of the borrowing company's PE sponsors has to be part of a group that also runs one or more CLO managers. Moreover, at least one of these affiliated CLO managers has to make a loan purchase in the issuance month. We do this, as PE firms without actively investing affiliated CLO managers cannot use this capital source to fund their deals. By design, their loan facilities have an AFB of zero and their inclusion would provide no additional information on the mechanisms behind the affiliated investment bias. This restriction results in 783 loan facilities finally being included in the AFB analysis.

Table III.9: This table presents summary statistics for the *Affiliated Funding Bias*, *Affiliated Funding Share* and *Expected Affiliated Funding* of loan facilities in the primary market. A facility has to have an *Expected Affiliated Funding* of larger than zero to be eligible for inclusion in the AFB analysis. We report the mean, standard deviation and median as well as the 10th, 25th, 75th and 90th percentile to give an overview of the range of occurring values.

	N	mean	sd	p10	p25	p50	p75	p90
Affiliated Funding Bias	783	0.031	0.157	-0.054	-0.031	-0.011	-0.001	0.184
Affiliated Funding Share	783	0.061	0.156	0.000	0.000	0.000	0.017	0.224
Expected Affiliated Funding	783	0.030	0.037	0.003	0.009	0.024	0.042	0.058

The average AFB in our sample is very large, at 3.1%. This implies that affiliated funding is approximately twice as high as the overall purchasing activity of affiliated CLO managers during the issuance month would suggest. With regard to the percentiles, it stands out that the AFB is concentrated in a small share of the sample. Despite being very large on average, the AFB at the 75th percentile is still negative. The positive skew of the AFB distribution reflects the fact, that only about 26% of all loan facilities with an *Expected Affiliated Funding* larger than zero also exhibit actual affiliated funding. Thus, the remaining 74% must have a negative AFB by definition.

To illustrate the cause of the AFB concentration, consider the following example. In July 2015 the three companies "Univar Solutions", "Vedici" and "AlixPartners", which were all sponsored by the PE firm "CVC Capital Partners", issued new loan facilities. In this month, CLOs managed by CVC accounted for approximately 2.9% of all loan purchases in our dataset, which is close to the average *Expected Affiliated Funding* in the sample. While none of these CLOs acquired the loans of Vedici- or AlixPartners in the primary market, the facility issued by Univar was bought by Cordatus Loan Funds II and IV, two CLOs managed by CVC. As a result, two of the three facilities exhibited an AFB of -2.9%. However, the affiliated funding for the Univar loan accounted for about 23% of its total primary market purchase volume in our dataset. Hence, the AFB was slightly more than 20% for this facility, and approximately 4.7% on average for loans issued by companies in CVCs PE portfolio in July 2015.

III.4.3 Incentive-driven mechanisms

III.4.3.1 Hypothesis development

According to the results in section III.4.1, the affiliated investment bias doesn't seem to be rooted in similar investment strategies of the CLO manager and the PE firm of the same group. Therefore, we now examine whether the mere existence of an affiliation with a sponsor of the borrowing company is related to incentives for the CLO manager to purchase a loan, regardless of its other caharcteristics. At the group level, one possible incentive for the debt arm to exhibit a bias towards affiliated investments explicitly in the primary market is to improve the funding conditions for loan-issuing companies of the group's PE firm. This funding support could operate through two different channels. Buchner et al. (2022) find that PE-affiliated debt funds provide interest rebates to PE firm's portfolio companies issuing new loans. Geburtig et al. (2025) observe lower credit spreads through a decreasing shareholder-creditor agency conflict, if a company has debt and equity holders belonging to the same group. Both of these channels would have a similar effect, namely the improvement of funding conditions for the borrowing company. Furthermore, the fact that financing terms are primarily relevant when a company is raising new capital is consistent with the lack of a meaningful affiliated investment bias in

secondary market purchase decisions. We refer to this potential bias mechanism as funding support hypothesis.

In the primary market, the CLO manager's intention to buy is not the only condition for a loan purchase. In the case of oversubscribed loans, the success of the bid also depends on the allocations made by the arranging banks. If (lead) arrangers are incentivized to favor CLO managers affiliated with the issuning company's PE sponsors in the allocation process, CLO portfolios may end up with a higher proportion of affiliated loans, regardless of their own purchase decisions.

Previous literature on IPOs describes two key channels that play a role in the primary market allocation of shares. The first was introduced by Benveniste and Spindt (1989) who provide a theoretical framework for a bookbuilding process under asymmetric information. According to this theory, underwriters incentivize investors to reveal private information about the value of the firm by allocating them underpriced shares in the primary market. The second is based on Loughran and Ritter (2002) who propose that underwriters allocate shares to investors with whom they have an intense business relationship. By rewarding them for generating revenue, underwriters incentivize their best clients to continue doing business with them in order to maintain a preferred allocation status.

Jenkinson et al. (2018) find empirical evidence for the role of both, the information revelation channel and the revenue generation channel in the allocation process of IPOs. They discover that bookrunners grant preferential allocations to investors whose bidding behavior is associated with the provision of information. Moreover, bookrunners favor investors who have participated in meetings with the issuing firm, as well as the bookrunners themselves, prior to the launch of the IPO. As these meetings may be used to obtain private information about the IPO valuation, these results are in line with the information revelation channel. In addition, Jenkinson et al. (2018) find that preferential allocations are positively related to the total revenues of an underwriter-bookrunner relationship, which provides evidence for the revenue generation channel.

The majority of studies on primary market allocations focus on equity IPOs. However, using a sample of insurers investing in newly issued corporate bonds, Nikolova et al. (2020) show that

the allocation mechanisms in the primary debt and equity markets are similar. Insurers with significant holdings in corporate bonds of a particular industry receive preferential allocations in new bond issuances of that industry. This suggests that the compensation for revealing private information increases with the level of an investor's industry expertise. Furthermore, as predicted by the revenue generation channel, a high previous trading volume between an insurer and the lead underwriters of a bond issuance is also indicative of preferential allocations.

In the context of newly issued leveraged loans, we expect CLO managers affiliated with the issuing company to receive even higher excess allocations than the favored investor groups in the primary equity and corporate bond market found by Jenkinson et al. (2018) and Nikolova et al. (2020). First, the revenue generation is more direct, since the CLO manager's affiliated PE firm has provided the arrangers with new business by commissioning them for the loan syndication in the first place. Second, the corporate affiliation suggests a much higher degree of private information about the issuing company compared to advanced industry expertise or the attendance at pre-issuance meetings.

Investors are only incentivized to reveal private information or generate business revenue for the arranger if they benefit from a positive price difference between the initial secondary and primary market price. Thus, for both channels to work, there must be systematic underpricing in the primary loan market. For leveraged loans, Bruche et al. (2020) find that, on average, new issuances are significantly underpriced, with a mean (median) difference of 85 (75) basis points between the secondary and primary market price. Moreover, they discover that underpricing increases with investor demand, a finding in line with the information revelation channel. Therefore, we expect that CLO managers affiliated with a PE firm sponsoring the issuing company receive preferential allocations. We refer to this rationale as the preferential allocation hypothesis.

III.4.3.2 Hypothesis testing

To test the incentive-driven bias mechanisms, we search for factors that should be associated with affiliated investing bias in the primary market if the hypotheses developed in Section III.4.3.1 were true. We then regress the AFB on these factors and assess whether the estimated

coefficients align with the predictions. Starting with the funding support hypothesis, we derive the test variable from a paper by Gil-Bazo et al. (2020), who find evidence for affiliated funding support in the issuance of new bonds. Using a sample of bank-affiliated mutual funds, they discover increased primary market purchases of bonds issued by their parent bank. Moreover, they find this affiliated funding to be especially high during periods of financial distress, when funding is more difficult for the bank. This underpins the hypothesis that banks utilize affiliated mutual funds to provide funding support for their new bond issues.

Gil-Bazo et al. (2020) use a post-Lehman dummy as indicator of financial distress. While the collapse of Lehman brothers occured approximately in the middle of their sample period, almost all of our loans were issued post-Lehman. Thus, we need a different measurement of financial distress. Ivashina and Sun (2011) utilize the number of days between the loan syndication and completion as an indicator of the difficulty of funding a loan. A longer "time-on-the-market" (ToM), suggests a more challenging search for investors willing to fund the facility. At the market level, the average ToM at a specific point in time is indicative of the overall imbalance of capital supply and demand, with longer syndication times during periods of bad funding conditions. For each month, we calculate the logarithm of the average time difference between the facilities "launch date" and "completion date" as reported by DealScan. As we are particularly interested in the funding conditions for the market segment of our sample loans, we only include PE sponsored loans purchased by CLOs in the average calculation. According to the funding support hypothesis, we would expect a positive coefficient for the time-on-market variable in the AFB regression, indicating more affiliated funding in periods of worse financing conditions.

Gil-Bazo et al. (2020) also employ three bank-specific factors, indicating the difficulty of funding an individual bond. However, using the loan-level duration of the syndication process would entail a significant reverse-causality problem.[8] On the one hand, similar to the market condition argument, we would expect more affiliated funding if a loan is harder to finance. On the other hand, according to the funding support hypothesis, investments by affiliated CLO

[8] As described in section III.4.1, we also lack information for the completion date on the loan level for the majority of facilities.

managers may improve funding conditions for the company, thereby simplifying the syndication process. Thus, there is no unambiguous prediction for the sign of the coefficients on the loan-level ToM or similar indicators of funding difficulty. Hence, we are only able to exploit market-level variation when testing the funding support hypothesis.

Regarding the preferential allocation hypothesis, we have described two potential channels that could incentivize an arranger to favor CLO managers affiliated with one of the issuer's PE sponsors in loan allocations. The revenue generation channel is based on the idea that preferential allocations to a CLO manager should incentivize its affiliated PE firm to commission the bank again as arranger for future deals. The value to an arranger of maintaining a business relationship with a PE firm is directly related to the loan volume it generates. Thus, we use the inflation-adjusted volume of all new loan issuances by a PE firm's portfolio companies over the previous five years, where the arranger acted in a lead role, as a measurement of their business relationship at a specific point in time.[9] For each loan where we have data on the AFB, we then calculate the mean value of the relationship variable for all sponsor-lead arranger combinations at the time of issuance.[10] If CLO managers run by groups whose PE firms have an intense business relationship to the arrangers were favored in the allocation process, we would expect a positive coefficient on the loan-level relationship variable in the AFB regression.

With respect to the information revelation channel, we expect the value of private information to increase with the level of pricing uncertainty. Consistent with this assumption, Nikolova et al. (2020) find that excess allocations for highly informed bidders decrease if other bonds of the same borrower have been traded more frequently in the time preceding the new bond issuance. Following the same approach, we use the trading data of CLO-i to generate a variable that captures the number of trades of the issuing company's other outstanding loan facilities during the three months preceding the issuance. This trading frequency variable should be

[9]We assume that a bank acts as lead arranger of a loan issuance if one of the three following conditions is met:
-The DealScan variable *Lead Arranger Credit* takes the value "Yes".
-The DealScan variable *Lender Role* takes one of the following values: "Admin agent", "Agent", "Arranger", "Coordinating arranger", "Lead arranger", "Lead bank", "Lead manager".
-The bank is the only arranger of the facility appearing in the DealScan database.

[10]E.g., A loan facility with the lead arrangers Citibank and Wells Fargo issued by a company sponsored by Blackstone Group and KKR has four sponsor-arranger combinations: "Blackstone Group-Citibank", "Blackstone Group-Wells Fargo", "KKR-Citibank" and "KKR-Wells Fargo".

negatively associated with the AFB if the bias is (partially) explained by preferential allocations resulting from the high value of information revealed by affiliated CLOs during the price building process.

Table III.10 presents the results of the AFB regression. In columns (1) to (3), we separately regressed the AFB on each of the three variables described above. In column (4), we included all predictive variables in a single model. We used sponsor fixed effects to control for endogeneity at the cross-sectional level. About 69% of loans in the AFB sample are issued by companies with only one sponsor, while 31% are sponsored by two or more different PE firms. We construct the sponsor fixed effects by building a separate dummy for each occurring combination of PE firms (i.e., "Bain Capital, Carlyle Group"). To control for variation in the time dimension, we use monthly fixed effects in columns (2) and (3). As *Log(1+Market Average ToM)* is a market-wide variable measured on the month-level, the implementation of monthly fixed effects is not feasible due to perfect multicollinearity. Instead, we use the month as a continuous time variable, in order to at least control for longer-term underlying time trends persisting over our sample period.

Column (1) shows a statistically significantly positive estimator for the *Log(1+Market Average ToM)* coefficient. This result aligns with the funding support hypothesis. Simultaneously, the positive *Log(1+5yr Lead-Sponsor-Vol)* and the negative $\#\ Trades\ Borrower_{t-3}^{t-1}$ coefficient in columns (2) and (3) provide evidence for the preferential allocation hypothesis. Moreover, the fact that both estimators are significant and have the predicted sign suggests that the revenue generation and information revelation channel both play a role in the allocation advantage. Column (4) shows that including all of the variables in one model only leads to minor changes in the size and significance of the estimators.

The calculation method for the AFB as described in equation (5) suggests that the magnitude of the AFB is independent from the level of *Expected Affiliated Funding*. However, this does not have to be the case in reality. On the one hand, the *Affiliated Funding Share* could have a proportional relationship with the *Expected Affiliated Funding*. This would imply a positive relation between AFB and *Expected Affiliated Funding*. On the other hand, some affiliated funding may happen independently of the other purchase activity of the affiliated CLOs, resulting

Table III.10: This table presents coefficient estimates for the regression of the *Affiliated Funding Bias* and *Affiliated Funding Share* on different variables associated with potential bias mechanisms. *Log(1+Market Average ToM)* is an indicator of the funding conditions in the market. *Log(1+5yr Lead-Sponsor-Vol)* is a proxy for the relationship between the PE firm(s) sponsoring the borrowing company and the investment banks arranging the loan issuance. # $Trades\ Borrower_{t-3}^{t-1}$ indicates the degree of uncertainty in the price building process. All variables are explained in appendix Table III.A.1. The constant is estimated but not reported. Standard errors are clustered at the issuance month with the corresponding p-values reported in parentheses.

	Affiliated Funding Bias				Affiliated Funding Share			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(1+Market Average ToM)	0.043			0.038	0.043			0.038
	(0.018)			(0.034)	(0.020)			(0.037)
Log(1+5yr Lead-Sponsor-Vol)		0.010		0.009		0.010		0.009
		(0.029)		(0.008)		(0.027)		(0.008)
# Trades $\text{Borrower}_{t-3}^{t-1}$			-0.002	-0.002			-0.002	-0.002
			(0.003)	(0.003)			(0.003)	(0.003)
Expected Affiliated Funding					1.143	0.781	0.865	1.059
					(0.099)	(0.230)	(0.192)	(0.123)
Month	-0.000			-0.000	-0.000			-0.000
	(0.378)			(0.318)	(0.396)			(0.347)
Sponsor FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	No	Yes	Yes	No	No	Yes	Yes	No
N	783	783	783	783	783	783	783	783
adj. R^2	0.055	0.097	0.104	0.067	0.044	0.086	0.093	0.056

in a negative relation between AFB and *Expected Affiliated Funding*. We consider these possibilities by changing the dependent variable to the *Affiliated Funding Share* in columns (5)-(8). To still account for the market-wide purchase acticity of affiliated CLOs, we add *Expected Affiliated Funding* as independent variable to the regression model. Comparing the coefficients of columns (5)-(8) to the corresponding columns (1)-(4) shows almost no effect of the model choice on the estimates. Furthermore, the *Expected Affiliated Funding* coefficients are in the range of one, suggesting that the AFB is largely unrelated to the overall level of purchase activity by affiliated CLOs during the issuance month of a loan facility.

III.5 Conclusion

CLO managers and PE firms are often run by the same asset management group. These corporate structures, along with the large overlap between the target companies of the two investor groups, lead to a significant share of affiliated investments in CLO portfolios. In addition, our analysis shows that CLO managers exhibit a bias towards affiliated investments, increasing their proportion above the level that would naturally result from coinciding investment decisions. Compared to benchmark portfolios CLOs overweight affiliated investments by more than a factor of two. A purchase decision level analysis of feasible investment opportunities shows a 30%-35% higher purchase probability if a PE sponsor of the borrowing company is affiliated with the potentially buying CLO manager. Including CLO-facility fixed effects in the regression model results in much larger coefficients, suggesting that the approximately one third-increase in purchase probability may even be an underestimate of the true effect size.

Differences between the affiliated investment bias in the primary and secondary market contradict the hypothesis of similar preferences for company characteristics in CLO managers and PE firms of the same group as driving mechanism behind the bias. Analyzing primary market funding at the facility level, we find a higher affiliation bias during periods of difficult financing conditions, if the sponsoring PE firm has a strong business relationship with the lead arranger and for facilities with a higher degree of pricing uncertainty. These results suggest that both funding support through affiliated CLO managers and preferential allocations by arrangers

contribute to the observed bias. Moreover, the findings indicate that the arrangers' motives for the preferential allocations are to incentivize the revelation of private information and to reward the generation of business revenue.

After examining the mechanisms behind the affiliated investment bias, its implications for CLO investors remain an open question. Gil-Bazo et al. (2020) find that bonds with primary market investments of mutual funds affiliated with the issuing bank have abnormal negative returns on the issuance day and week. Other authors observe a negative relationship between the return of a mutual fund and the portfolio weight of the stocks of creditors (Ferreira et al., 2018) and IPO clients (Hao and Yan, 2012) of the fund manager's parent bank. For a sample of debt funds, Buchner et al. (2022) discover underperformance in affiliated investments. However, PE firm-affiliated debt funds don't show worse overall returns, as they outperform in unaffiliated trades. On the contrary, Geburtig et al. (2025) find that CLO managers earn positive excess returns in affiliated loan trades. The relationship between a CLO's affiliated investment bias and the return for its investors might be a fruitful topic for future research.

III. References

Abadie, A., S. Athey, G. W. Imbens, and J. M. Wooldridge (2023). When should you adjust standard errors for clustering? *The Quarterly Journal of Economics 138*(1), 1–35.

Axelson, U., T. Jenkinson, P. Strömberg, and M. S. Weisbach (2013). Borrow cheap, buy high? The determinants of leverage and pricing in buyouts. *The Journal of Finance 68*(6), 2223–2267.

Becker, B. and V. Ivashina (2015). Reaching for yield in the bond market. *The Journal of Finance 70*(5), 1863–1902.

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

Benveniste, L. M. and P. A. Spindt (1989). How investment bankers determine the offer price and allocation of new issues. *Journal of financial Economics 24*(2), 343–361.

Bozanic, Z., M. Loumioti, and F. P. Vasvari (2018). Corporate loan securitization and the standardization of financial covenants. *Journal of Accounting Research 56*(1), 45–83.

Bruche, M., F. Malherbe, and R. R. Meisenzahl (2020). Pipeline risk in leveraged loan syndication. *The Review of Financial Studies 33*(12), 5660–5705.

Buchner, A., F. Lopez-de Silanes, and A. Schwienbacher (2022). Private equity debt funds: Who wins, who loses? Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4118522. Accessed: September 12, 2023.

Choi, J. and M. Kronlund (2018). Reaching for yield in corporate bond mutual funds. *The Review of Financial Studies 31*(5), 1930–1965.

Coval, J. D. and T. J. Moskowitz (1999). Home bias at home: Local equity preference in domestic portfolios. *The Journal of Finance 54*(6), 2045–2073.

Donde, A. (2016). Bain's sankaty rebrands. Available at https://www.privatedebtinvestor.com/bains-sankaty-rebrands/. Accessed: December 19, 2023.

Elkamhi, R. and Y. Nozawa (2022). Fire-sale risk in the leveraged loan market. *Journal of Financial Economics 146*(3), 1120–1147.

Ferreira, M. A., P. Matos, and P. Pires (2018). Asset management within commercial banking groups: International evidence. *The Journal of Finance 73*(5), 2181–2227.

Financial Stability Board (2019). Vulnerabilities associated with leveraged loans and collateralised loan obligations. Available at https://www.fsb.org/uploads/P191219.pdf. Accessed: February 8, 2023.

Fitch Ratings (2014). *CLO Asset Manager Handbook* (3rd ed.). New York, London.

Fitch Ratings (2023). The 2023 annual manual: A primer on the u.s. leveraged finance market. Available at https://your.fitch.group/rs/732-CKH-767/images/The-2023-Annual-Manual-%28A-Primer-on-the-U.S.-Leveraged-Finance-Market%29_10229378.pdf. Accessed: September 25, 2024.

Geburtig, I., T. Mählmann, and R. Liebscher (2025). Dual holdings and shareholder–creditor agency conflicts: Evidence from the syndicated loan market. *Journal of Business Finance & Accounting 52*(1), 222–260.

Gil-Bazo, J., P. Hoffmann, and S. Mayordomo (2020). Mutual funding. *The Review of Financial Studies 33*(10), 4883–4915.

Hao, Q. and X. Yan (2012). The performance of investment bank-affiliated mutual funds: conflicts of interest or informational advantage? *Journal of financial and Quantitative Analysis 47*(3), 537–565.

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

Ivković, Z. and S. Weisbenner (2005). Local does as local is: Information content of the geography of individual investors' common stock investments. *The Journal of Finance 60*(1), 267–306.

Jenkinson, T., H. Jones, and F. Suntheim (2018). Quid pro quo? what factors influence ipo allocations to investors? *The Journal of Finance 73*(5), 2303–2341.

Kakouris, R. (2022). Amid more rate hikes, pe-backed leveraged loan issuers eye rising costs, outsized risk. Available at https://pitchbook.com/news/articles/amid-more-rate-hikes-pe-backed-leveraged-loan-issuers-eye-rising-costs-outsized-risk. Accessed: February 20, 2023.

Kundu, S. (2023). The anatomy of corporate securitizations and contract design. *Journal of Corporate Finance 81*, Article 102195.

Kundu, S. (2024). Financial covenants and fire sales in closed-end funds. *Management Science 70*(2), 860–884.

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

Lin, M. and S. Viswanathan (2016). Home bias in online investments: An empirical study of an online crowdfunding market. *Management Science 62*(5), 1393–1414.

Loughran, T. and J. R. Ritter (2002). Why don't issuers get upset about leaving money on the table in ipos? *The Review of Financial Studies 15*(2), 413–444.

Loumioti, M. and F. P. Vasvari (2019). Portfolio performance manipulation in collateralized loan obligations. *Journal of Accounting and Economics 67*(2-3), 438–462.

Mählmann, T. (2022). Negative externalities of mutual fund instability: Evidence from leveraged loan funds. *Journal of Banking & Finance 134*, 106328.

Martin, J. and A. Sayrak (2022). Collateralized loan obligations: A primer. *Journal of Applied Corporate Finance 34*(3), 35–50.

Nadauld, T. D. and M. S. Weisbach (2012). Did securitization affect the cost of corporate debt? *Journal of Financial Economics 105*(2), 332–352.

Nikolova, S., L. Wang, and J. J. Wu (2020). Institutional allocations in the primary market for corporate bonds. *Journal of Financial Economics 137*(2), 470–490.

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

Shivdasani, A. and Y. Wang (2011). Did structured credit fuel the LBO boom? *The Journal of Finance 65*(4), 1291–1327.

Smith, P. and J. Politi (2006). Kkr in record $33bn deal for hca. Available at https://www.ft.com/content/63845bbe-1aca-11db-848c-0000779e2340. Accessed: December 19, 2023.

S&P Global Market Intelligence Inc. (2020). Leveraged commentary & data (lcd): Leveraged loan primer. Available at https://www.lcdcomps.com/d/pdf/LCD%20Loan%20Primer.pdf. Accessed: October 22, 2023.

Zheng, L. and X. Yan (2021). Financial industry affiliation and hedge fund performance. *Management Science 67*(12), 7844–7865.

III. Appendix

Table III.A.1: In this table the variables in use are described.

Variable	Source	Unit	Description
Panel A: Loan facility variables			
# Syndicate Members	DealScan	Count	Number of lenders in the syndicate according to DealScan.
# Trades Borrower$_{t-3}^{t-1}$	CLO-i (own computation)	Count	Number of trades of other facilities by the same borrowing company in the three months before issuance.
5yr Lead-Sponsor-Vol	DealScan	Mio. USD	For every lead arranger-sponsor combination of the facility, the sum of all inflation-adjusted facility amounts the arranger had (as lead arranger) with the sponsor in the five years prior to the issuance date is computed. The mean value across all sponsor-lead arranger combinations is taken.
Affiliated Funding Bias	CLO-i (own computation)	Proportion	Difference between Affiliated Funding Share and Expected Affiliated Funding
Affiliated Funding Share	CLO-i (own computation)	Proportion	For Facility i purchased by n different CLOs j in the primary market: $\frac{\sum_{j=1}^{n} \text{Primary market purchase volume}_{i,j} * \text{Affiliation}_{i,j}}{\sum_{j=1}^{n} \text{Primary market purchase volume}_{i,j}}$
Expected Affiliated Funding	CLO-i (own computation)	Proportion	For Facility i issued in month m with o different CLOs j with at least one loan purchase in the CLO-i dataset: $\frac{\sum_{j=1}^{p} \text{Monthly purchase volume}_{j,m} * \text{Affiliation}_{i,j}}{\sum_{j=1}^{p} \text{Monthly purchase volume}_{j,m}}$
Facility Amt	DealScan, FRED	Mio. USD	Facility amount as available from DealScan adjusted to end of 2015 USD (FRED ticker CPIAUCSL).
LBO/SBO	DealScan	0/1	Dummy that is one if *PrimaryPurpose* of loan is "LBO" or "SBO".
PD	CLO-i (own computation)	%	Mean of Moody's PD and S&P's PD.

continued on next page

Variable	Source	Unit	Description
Performance Pricing	DealScan	0/1	Dummy that is one if facility has a performance pricing schedule.
Primary Market	CLO-i	0/1	Dummy that is one if facility is purchased in the primary market and zero if it is purchased in the secondary market.
Rating adjusted Spread	CLO-i (own computation)	%	Spread on facility in excess of the average spread of all facilities traded in the same month and displaying the same rating letter (averaged over Moody's and S&P).
Secured	DealScan	0/1	Dummy that is one if facility is secured.
Panel B: CLO variables			
Affiliated Investment Overweight	CLO-i (own computation)	Proportion	Overweight of affiliated investments against benchmark portfolio: $\text{AIO}_{i,q} = \frac{\sum_{k=1}^{n} \text{Par Value}_{i,k,q} * \text{Affiliation}_{i,k,q}}{\text{Portfolio Size}_{i,q}} - \frac{\sum_{l=1}^{m} \text{Par Value}_{j,l,q} * \text{Affiliation}_{i,l,q}}{\text{Portfolio Size}_{j,q}}$
Average PD	CLO-i (own computation)	%	Par value weighted average PD (see. definition in Panel A) of portfolio holdings.
Portfolio Size	CLO-i (own computation)	Mio. USD	Inflation adjusted size of all assets held by a CLO.
Ramp-up Period	CLO-i	0/1	Indicator variable that is one if the CLO's life cycle is before the effective date.
Reinvestment Period	CLO-i	0/1	Indicator variable that is one if the CLO's life cycle is after the effective date and before the end of reinvestment period.
USD Share	CLO-i (own computation)	Proportion	Share of portfolio assets denominated in USD.
Panel C: CLO-loan facility variables			

continued on next page

Variable	Source	Unit	Description
Affiliation	CLO-i, DealScan (own computation)	0/1	Indicator variable that is one if sponsor of loan or bond is affiliated with CLO manager trading (holding) the instrument. See Section III.2.2 for details.
Affiliated Sale	CLO-i (own computation)	0/1	Dummy variable that is one if affiliated CLO sells the same loan at same date, motivated by the findings in Loumioti and Vasvari (2019).
Realized Purchase	CLO-i	0/1	Dummy that is one if facility is purchased and zero otherwise.
Same Currency	CLO-i	0/1	Indicator variable that is one if facility is denominated in the same currency as the CLO.
Panel D: Macro variables			
HY bond spread over LIBOR	Merril Lynch, FRED	%	U.S. High Yield Corporate Bond Index (Yield) minus 3-month-LIBOR motivated by its use as proxy for debt market conditions in Axelson et al. (2013).
Market Average ToM	DealScan (own computation)	Days	Monthly average of calendar days between "launch date" and completion date" of sponsored loan facilities with CLO investors.

IV. Revisions to the Basel securitization framework and their impact on CLOs

Ingo Geburtig

Abstract

In December 2017, the European regulation on capital requirements for securitizations was comprehensively revised. This paper examines the impact of these revisions on collateralized loan obligations (CLOs). A comparison of the results of risk weight calculations for a typical CLO under the previous and revised frameworks shows an overall increase in capital requirements. The increase is particularly pronounced under the new standardized approach (SEC-SA). However, difference-in-difference analyses of credit spreads indicate no effect of the higher capital requirements on the interest rates of CLO tranches. These results suggest that the cost of regulatory capital requirements for banks is limited.

Keywords: Basel securitization framework, capital requirements, collateralized loan obligations

JEL Classification: G21, G23, G28

IV.1 Introduction

Asset-backed securities (ABS) were at the center of the global financial crisis of 2007-2009 (Cordell et al., 2012). At that time, capital requirements for securitizations were based almost entirely on external ratings, creating incentives for regulatory capital arbitrage and rating inflation (Opp et al., 2013). Empirical evidence suggests that banks would indeed tilt their ABS investments toward the highest-yielding tranches among securitizations with the same rating-induced risk weight (Efing, 2020). Moreover, rating agencies required decreasing amounts of subordinated capital to assign high ratings to securitization tranches (Stanton and Wallace, 2018).[1]

Overcoming the mechanistic reliance on external ratings was one of the main reasons for the revisions to the Basel securitization framework, which were published as a first draft in December 2014 (Basel Committee on Banking Supervision, 2014). Following the publication of the final version in July 2016 (Basel Committee on Banking Supervision, 2016), the revisions to the framework were implemented in the European Union by Regulation (EU) 2017/2401 (European Parliament and Council, 2017). This regulation, which was adopted on December 12, 2017 and came into force at the beginning of 2019, mainly revised Part THREE, Title II, Chapter 5 of Regulation (EU) No 575/2013, commonly known as the Capital Requirements Regulation (CRR).[2]

The European securitization market comprises many different ABS subtypes with a total outstanding volume of approximately € 1.2 trillion in 2024. Accounting for 21% of the total volume, collateralized loan obligations (CLOs) are the second largest group of securitizations in Europe after residential mortgage-backed securities (RMBS) (Association for Financial Markets in Europe, 2025). Some problems of other securitization types, such as adverse selection in

[1] The amount of subordinated capital determines the level at which losses in the underlying pool begin to be allocated to a specific securitization tranche. Thus, less subordinated capital means that the tranche becomes more risky.

[2] From its adoption in 2013 until 2024, the CRR has been amended by 12 EU regulations, 4 commission delegated regulations and 1 commission implementing regulation. These amendments may have also altered the numbering of paragraphs that remain unchanged in substance. When I cite the CRR (2024) in this paper, I generally refer to the consolidated version as of July 9, 2024. However, in some places, I discuss paragraphs that no longer exist in the CRR (2024). In these cases, I refer to the original version of the CRR (2013) as adopted on June 26, 2013.

the underlying pool, don't occur in the CLO market (Benmelech et al., 2012). As a results, unlike other ABS types, CLO tranches suffered limited losses during the financial crisis (Cordell et al., 2023). Despite their historically lower risk, CLOs are subject to the changes in capital requirements associated with the framework revisions.

This paper examines the impact of the revisions to the Basel framework on CLOs. It begins with an analysis of the risk weights of typical CLO tranches under the previous framework. Before the framework revisions, the risk weight of an externally rated CLO tranche[3] under the standardized approach depended solely on its rating. The internal ratings based (IRB) approach incorporated an additional distinction between senior and non-senior tranches with the same rating. Thus, all AAA-rated senior tranches had risk weights of 7% under the IRB approach and 20% under the standardized approach. For a class C mezzanine CLO tranche with a typical rating of A (Martin and Sayrak, 2022), the risk weights were 50% under the standardized approach and 20% under the IRB approach.

Under the new framework, there are three approaches with a defined hierarchy of application. The internal ratings based approach (SEC-IRBA) is at the top of the hierarchy. However, the use of the SEC-IRBA requires sufficient information and an adequate internal model to estimate specific parameters of the underlying loan pool. If these requirements aren't met, the weights of externally rated securitization tranches are determined by the standardized approach (SEC-SA) or the external ratings based approach (SEC-ERBA). The choice between SEC-SA and SEC-ERBA depends on the two risk weights that would result from using each of the approaches.

The SEC-ERBA is the simplest of the three approaches. In comparison to the previous IRB approach, it uses the tranche maturity and, for non-senior tranches, the tranche thickness as additional parameters. In this context, tranche thickness is defined as the difference between the detachment point (i.e., the threshold at which losses in the underlying would result in a complete loss of the tranche) and the attachment point (i.e., the threshold at which losses in the underlying start to be allocated to the tranche). The resulting 20% risk weight for a AAA-rated senior CLO tranche is identical to the previous standardized approach. In contrast, the risk weight for a typical class C tranche increases dramatically to 169%.

[3]CLO tranches are typically externally rated (Kundu, 2023).

The SEC-SA does not rely on external ratings, but instead uses various parameters of the CLO's capital structure and underlying to determine the risk weight of a tranche. The capital structure component consists of the tranche's attachment and detachment points. The risk estimate of the underlying is based on the hypothetical risk weight if the pool hadn't been securitized, adjusted for the fraction of the underlying loans that are already in default. In general, the SEC-SA results in much higher risk weights than the SEC-ERBA. For the typical CLO, the risk weight of the senior (class C) tranche increases to 38.5% (618%).

The SEC-IRBA is the most complex of the three approaches. Like the SEC-SA, it uses the attachment and detachment points, as well as the hypothetical risk weight of the non-securitized underlying to determine the risk weight of a CLO tranche. However, the hypothetical risk weight of the underlying is based on the IRB approach instead of the standardized approach to credit risk. As in the SEC-ERBA, the risk weights are adjusted for the tranche maturity. In addition, the SEC-IRBA accounts for the degree of diversification in the underlying pool by the effective number of exposures, which combines the number of positions and the distribution of portfolio weights. The SEC-IRBA results in significantly lower risk weights than the other two approaches. At 15% for the senior tranche and 41% for the class C tranche, the risk weights for a typical CLO are between those calculated under the previous IRB and standardized approaches.

The overall higher risk weights of the revised securitization framework leads to the hypothesis that its implementation should have an increasing effect on the interest rates on CLO tranches. However, the regression of CLO tranche credit spreads on a time dummy separating the periods before and after the adoption of Regulation (EU) 2017/2401 (European Parliament and Council, 2017) indicates lower spreads following the framework revisions. More importantly, although the US did not adopt the new framework, there is no statistically significant difference between the spread decrease in European and US CLOs. Moreover, the simultaneous decline in spreads of European and US CLO tranches occurs independently of the tranche type-specific share of capital held by banks. These results contradict the hypothesis of a spread increasing effect of the framework revisions and instead suggest that the costs of regulatory capital for banks are limited.

The first part of the paper complements existing studies that examine the effect of the revi-

sions to the Basel framework on capital requirements for securitizations. The Basel Committee on Banking Supervision regularly conducts monitoring exercises to estimate the impact of regulatory changes on the aggregate capital requirements of banks. The Basel III monitoring report of September 2017 presents the results of the first exercise incorporating the framework revisions (Basel Committee on Banking Supervision, 2017). For 88 banks from committee member countries, the average risk weight of the securitization portfolios as of December 2016 was expected to increase from 29.7% to 45.7% through the framework revisions. Two years later, the pre- and post-revision risk weights decreased to 24.3% and 34.6%, respectively (Basel Committee on Banking Supervision, 2019). Unlike the monitoring reports, which provide results for the aggregate ABS market, this paper focuses specifically on the change in risk weights for CLOs. Furthermore, to the best of my knowledge, this paper is the first to examine the sensitivity of risk weights to changes in individual parameters of the new approaches introduced by the framework revisions.

The second part of the paper contributes to the literature on the costs of regulatory capital requirements for banks. Studies using difference-in-difference analysis of loans find that interest rates are significantly sensitive to regulatory capital requirements for UK mortgages (Benetton et al., 2021), US commercial real estate loans (Glancy and Kurtzman, 2022) and Italian corporate loans (di Patti et al., 2023). In contrast, results from papers with different settings, such as undrawn fees of credit lines (Plosser and Santos, 2024) or the provision of liquidity guarantees to asset-backed commercial paper (ABCP) conduits (Kisin and Manela, 2016), indicate low costs of regulatory capital requirements for banks. My results are consistent with the findings of the second group of papers and diverge from those of the first.

The remainder of this paper is structured as follows: Section IV.2 provides an overview of the capital requirements before the revisions to the Basel securitization framework. Section IV.3 entails a detailed analysis of the three approaches under the revised securitization framework. In section IV.4, I examine the relationship between spreads and risk weights of CLO tranches, followed by a concluding summary in section IV.5.

IV.2 RWA calculation before the revisions

Before the framework revisions by Regulation (EU) 2017/2401 (European Parliament and Council, 2017) in December 2017, there were two main approaches for calculating the risk-weighted assets (RWA) of securitization exposures. As for the general credit risk, there was a standardized and an internal rating based (IRB) approach. The approach selected for securitization positions depended on the method used for the exposure class of the underlying, i.e. either the standardized or the IRB approach was used uniformly for holdings of the same exposure class, regardless of whether they were securitized or not (CRR, 2013, Art. 109). Since the underlying of CLOs consists of corporate loans, the approach used to determine the RWA of CLO tranches depended on the bank's RWA calculation method for exposures to corporates (CRR, 2013, Art. 112(g)). Despite having the same names, the standardized and IRB approach for securitization exposure were methodologically unrelated to the approaches used for credit risk of non-securitized exposure. For general credit risk, the standardized approach relies on external ratings, while a bank applying the IRB approach uses its internal rating systems to determine the RWA of its exposure (Basel Committee on Banking Supervision, 2006). However, for securitization exposure, both systems are based on credit ratings of external agencies.

Under the standardized approach, the risk weight of externally rated securitization exposure was based on five different credit quality steps (CRR, 2013, Art. 251). Annex 1 of Commission Implementing Regulation (EU) 2016/1801 (European Commission, 2016b) mapped the rating grades of common rating agencies to the five credit quality steps used to determine the risk weight. If a tranche had more than one external credit assessment, the second best rating was used to determine the credit quality step (CRR, 2013, Art. 269(2)). Thus, in the case of two ratings, the worse one was used, while the median rating was taken if there were three external credit assessments.

The rightmost column in Table IV.1 shows the relationship between rating and risk weight for the standardized approach. For any investment grade rating notch (BBB- or better), the risk weight of securitization tranches was identical to that of non-securitized corporate exposure, both ranging from 20%-100%. However, for non-investment grade securitization exposure

(rating BB+ or worse), the risk weights of 350% or 1.250% were much higher than the 100% or 150% risk weight of other corporate credit (CRR, 2013, Art. 122; European Commission, 2016a, Annex III). To calculate the RWA, which are the reference point for capital requirements, the risk weights had to be multiplied by the exposure values of the positions. (CRR, 2013, Art. 251). The exposure value was defined as the accounting value after the application of credit risk adjustments (CRR, 2013, Art. 246).

Table IV.1: This table illustrates the relationship between external ratings and risk weights prior to the implementation of the framework revisions. The values in columns 1 and 2 (3) were applied if the bank used the IRB (standardized) approach to calculate the RWA in the exposure class of the underlying pool. The rating scale refers to S&P and Fitch. Moody's uses a similar rating scale with a lowercase "a" replacing any second or third letter in the other two rating scales. In addition, the number 1 (3) replaces the + (-) symbol and the number 2 is added for ratings without an additional symbol on the S&P and Fitch scale.

	IRB Approach		
Rating	Senior Tranche	Non-senior Tranches	Standardized Approach
AAA	7%	12%	20%
AA+ bis AA-	8%	15%	
A+	10%	18%	50%
A	12%	20%	
A-	20%	35%	
BBB+	35%	50%	100%
BBB	60%	75%	
BBB-	100%	100%	
BB+	250%	250%	350%
BB	425%	425%	
BB-	650%	650%	
Worse than BB-	1,250%	1,250%	1,250%

Within the IRB approach, there were three different sub-approaches for the risk weight calculation of securitization exposures: The ratings based method (CRR, 2013, Art. 261), the supervisory formula method (CRR, 2013, Art. 262) and the internal assessment approach (CRR, 2013, Art. 259(4)). The use of the supervisory formula method was limited to unrated positions (CRR, 2013, Art. 259(1)b), which doesn't apply to most CLO tranches (Kundu, 2023). The internal assessment approach was only applied to exposures from the ABCP program (CRR, 2013, Art.259(3)). A requirement for inclusion in the ABCP program was an original maturity of one year or less (CRR, 2013, Art.242(9)). As CLOs typically have an original legal maturity of 11-13 years (Kollmorgen and Kramer, 2024), they don't qualify for the ABCP program.

Therefore, banks applying the IRB approach to corporate exposures have typically used the ratings based method to determine the RWA of their CLO investments.

In comparison to the standardized approach, the ratings based method had a much more granular scale, with twelve instead of five credit quality steps. In addition, senior tranches had a lower risk weight than tranches with the same rating that were subordinate to at least one other tranche of the securitization (CRR, 2013, Art. 261(1)). The mapping of ratings and credit quality steps was based on Annex 2 of Commission Implementing Regulation (EU) 2016/1801 (European Commission, 2016b). As under the standardized approach, in cases of more than one rating, the second best determined the credit quality step of the tranche (CRR, 2013, Art. 269(2)) and the risk weights had to be multiplied by the exposure value for RWA calculation. However, in contrast to the standardized approach, under the IRB approach the exposure value was defined as the accounting value without any credit risk adjustments (CRR, 2013, Art. 246(1)b). In addition, the RWA calculation included a scaling factor of 1.06, which had to be multiplied by the product of exposure value and risk weight (CRR, 2013, Art. 261(1)).

Table IV.2 illustrates the structure of a typical CLO and the corresponding risk weights for each tranche. The capital structure and tranche rates are based on the representative example CLO structure in Martin and Sayrak (2022). For all tranches up to the BBB-rated class D mezzanine tranche, the risk under the IRB approach was lower than under the standardized approach. For the typical senior tranche, the risk weight was as low as 7%. With regard to the tranche sizes of a typical CLO, the IRB assigned a risk weight of 20% or less to 81% of the total capital and 88% of the capital in debt tranches. Therefore, despite the higher risk weights for the more junior tranches, the overall capital requirements for CLO tranches under the previous IRB approach were low.

Table IV.2: This table illustrates the capital structure of a typical CLO and presents the results of the risk weight calculations for each of its debt tranches before the revisions to the securitization framework under the standardized and IRB approaches. The capital structure, spread and rating data are from Martin and Sayrak (2022). The rating scale refers to S&P and Fitch. Moody's uses a similar rating scale with a lowercase "a" replacing any second or third letter in the other two rating scales.

Tranche	Spread	% of Capital	Original Rating	Risk Weight$_{Stand}$	Risk Weight$_{IRB}$
A	120	63	AAA	20%	7%
B	175	12	AA	20%	15%
C	235	6	A	50%	20%
D	335	5	BBB	100%	75%
E	620	5	BB	350%	425%
F	790	1	B	1,250%	1,250.0%
Equity		8			

IV.3 RWA calculation after the revisions

IV.3.1 Hierarchy of approaches

Since the framework revisions, there are three approaches for calculating the RWA of securitization exposures: The internal ratings based approach (SEC-IRBA) (CRR, 2024, Art. 259), the standardized approach (SEC-SA) (CRR, 2024, Art. 261) and the external ratings based approach (SEC-ERBA) (CRR, 2024, Art. 264). The SEC-IRBA is at the top of the hierarchy and must be used if possible. A key input parameter of the SEC-IRBA is K_{IRB}, the IRB risk weight of the underlying if it hadn't been securitized, multiplied by 8% (CRR, 2024, Art. 255).[4] Therefore, the application of the SEC-IRBA requires that the bank uses the IRB approach to calculate the underlying exposure of the securitization and has sufficient information to determine its risk weight (CRR, 2024, Art. 258(1)). In order to apply the IRB approach to a specific exposure class, an institution must obtain prior permission from the competent authority (CRR, 2024, Art. 143(2)). As the underlying of CLOs are corporate loans, the corresponding class is exposures to corporates (CRR, 2024, Art. 147(2)c). The formal and substantial requirements for obtaining the permission for IRB usage are described in Section 1 and 6 of Part THREE, Title II, Chapter 3 in the CRR (2024).

If K_{IRB} can't be determined, banks use the SEC-SA if the resulting risk weight of a rated position is not higher than 25% and the use of SEC-ERBA wouldn't result in a risk weight of higher than 75%. If one of these conditions isn't met, institutions must use the SEC-ERBA

[4] See section IV.3.4.1 for a detailed description of K_{IRB}.

to determine the risk weight (CRR, 2024, Art. 254(1)b + Art. 254(2)b). Alternatively, an institution may decide to use the SEC-ERBA for all rated securitization positions. However, the decision must be made uniformly for all eligible securitizations, as an individual choice for rated exposures, fulfilling the requirements for SEC-SA usage, is not allowed (CRR, 2024, Art. 254(3)).

IV.3.2 SEC-ERBA

All three approaches of the revised framework have in common that a bank multiplies the risk weight by the accounting value after credit risk adjustments to determine the RWA of on-balance sheet securitization positions (CRR, 2024, Art. 248(1)a, Art. 259(1), Art. 261(1), Art. 263(1)). In the following three subsections, I will discuss the different methods of risk weight calculation, starting with the SEC-ERBA as it is the simplest of the three approaches. Under the SEC-ERBA, the risk weight RW_{ERBA} depends on the following four parameters: The external credit rating, the tranche maturity M_T, whether the position is a senior tranche or subordinate to at least one other tranche of the same securitization and the tranche thickness T. With 18 different credit quality steps, the relationship between credit rating and RW_{ERBA} is very granular (CRR, 2024, Art. 263(3)). The Annex of Commission Implementing Regulation EU 2022/2365 (European Commission, 2022) maps credit agency ratings to these 18 credit quality steps. As before the revisions, in the case of more than one external credit assessment, the second best rating determines the credit quality step (CRR, 2024, Art. 270d(2)b+c).

Tranche maturity M_T is positively related to RW_{ERBA}, reflecting higher default risks in longer-term securitizations. M_T of a tranche can be determined by either taking the cash flow-weighted average maturity of all payments to investors (i.e. coupons and redemptions) or by applying the following formula (CRR, 2024, Art. 257(1)):

$$M_T = 1 + (Legal\ Maturity - 1) * 0.8 \tag{1}$$

If the resulting value is below one, M_T is set to one year, if it is above five, M_T is set to five years (CRR, 2024, Art. 257(2)). Table IV.3 shows RW_{ERBA} for the cap and floor M_T of non-senior

tranches before thickness adjustments and senior tranches. If M_T is between one and five years, RW_{ERBA} is determined by linear interpolation between the floor and cap values.

Table IV.3: This table illustrates the relationship between external ratings, maturities and risk weights according to the SEC-ERBA. The rating scale refers to S&P and Fitch. Moody's uses a similar rating scale with a lowercase "a" replacing any second or third letter in the other two rating scales. In addition, the number 1 (3) replaces the + (-) symbol and the number 2 is added for ratings without an additional symbol on the S&P and Fitch scale. If M_T is between 1 and 5 years, RW_{ERBA} is calculated by linear interpolation between the values in columns 1 and 2 (3 and 4) for senior (non-senior) tranches. In addition, a thickness adjustment for non-senior tranches reduces the risk-weight by up to 50% compared to the values in columns 3 and 4.

	Senior Tranche		Non-senior Tranches	
Rating	M_T: 1 Year	M_T: 5 Years	M_T: 1 Year	M_T: 5 Years
AAA	15%	20%	15%	70%
AA+	15%	30%	15%	90%
AA	25%	40%	30%	120%
AA-	30%	45%	40%	140%
A+	40%	50%	60%	160%
A	50%	65%	80%	180%
A-	60%	70%	120%	210%
BBB+	75%	90%	170%	260%
BBB	90%	105%	220%	310%
BBB-	120%	140%	330%	420%
BB+	140%	160%	470%	580%
BB	160%	180%	620%	760%
BB-	200%	225%	750%	860%
B+	250%	280%	900%	950%
B	310%	340%	1,050%	1,050%
B-	380%	420%	1,130%	1,130%
CCC+ to CCC-	460%	505%	1,250%	1,250%
Worse than CCC-	1,250%	1,250%	1,250%	1,250%

To determine RW_{ERBA} of non-senior tranches, the values in the two rightmost columns of Table IV.3 must be adjusted for tranche thickness T. Consistent with the fact that, given the same probability of default, a higher tranche thickness is associated with a lower LGD (loss given default), higher values of T result in a lower RW_{ERBA}. While credit ratings take the LGD into account, analysis of the Basel Committee of Banking Supervision found that mezzanine tranches with higher thickness should still result in lower capital requirements than thinner tranches with the same rating (Basel Committee on Banking Supervision, 2016). RW_{ERBA} is adjusted for tranche thickness by the following formula (CRR, 2024, Art. 263(5)):

$$RW_{ERBA} = RW_{ERBA}^{pre-adj.} * (1 - min(T;\ 0.5)) \tag{2}$$

where T is the difference between detachment point D and attachment point A. D is the threshold at which losses within the underlying pool would result in a complete loss of the securitization tranche, described as a proportion of the underlying pool. Technically, D is defined by the following formula (CRR, 2024, Art. 256(2)).

$$D = \frac{Balance\ underlying\ Pool - Balance\ higher\ ranked\ Tranches}{Balance\ underlying\ Pool} \tag{3}$$

A is the threshold at which losses within the underlying pool would start to be allocated to the tranche (CRR, 2024, Art. 256(1)), defined as

$$A = \frac{Balance\ underlying\ Pool - Balance\ equal\ or\ higher\ ranked\ Tranches}{Balance\ underlying\ Pool} \tag{4}$$

Therefore, in the standard case of no equal ranking tranche, T is the ratio of the tranche balance to the total balance of the underlying pool. However, the thickness adjustment is limited by RW_{ERBA} of senior tranches, which serve as a floor for RW_{ERBA} of non-senior tranches with the same rating and maturity (CRR, 2024, Art. 263(6)).

Table IV.4 shows the RW_{ERBA} for each tranche of the typical CLO from Martin and Sayrak (2022). As CLOs typically have original legal maturities of 11-13 years (Kollmorgen and Kramer, 2024), I use the cap M_T of 5 years for the RW_{ERBA} calculation. For the thickness adjustment, I assume that the balance of the underlying pool is equal to the balance of all tranches. Under this assumption, the thickness T is equivalent to a tranche's share of the securitization's total balance.

Under the SEC-ERBA, the risk weights for most CLO tranches are significantly higher than before the framework revisions. For example, a typical Class C mezzanine tranche has an RW_{ERBA} of 169%, compared to risk weights of 20% under the IRB approach and 50% under the standardized approach prior to the framework revisions. For a typical CLO, only the most junior debt tranche has a slightly lower risk weight under the new SEC-ERBA (1,040% vs 1,250%) and the senior tranche's risk weight of 20% is the same as under the old standardized approach. However, even for the senior tranche, RW_{ERBA} is almost three times higher than

Table IV.4: This table illustrates the capital structure of a typical CLO and presents the results of the RW_{ERBA} calculations for each of its debt tranches under the SEC-ERBA. The capital structure, spread and rating data are from Martin and Sayrak (2022). The rating scale refers to S&P and Fitch. Moody's uses a similar rating scale with a lowercase "a" replacing any second or third letter in the other two rating scales. For the calculation of RW_{ERBA}, I made the assumption that M_T is five years and that the balance of the underlying pool loans is equal to the balance of all tranches (i.e., the thickness T of each tranche is identical to its % of capital).

Tranche	Spread	% of Balance	Original Rating	RW_{ERBA}
A	120	63	AAA	20.0%
B	175	12	AA	105.6%
C	235	6	A	169.2%
D	335	5	BBB	294.5%
E	620	5	BB	722.0%
F	790	1	B	1,039.5%
Equity		8		

the risk weight of 7% that would have resulted under the IRB approach before the framework revisions.

IV.3.3 SEC-SA

IV.3.3.1 Analytical approach

Under the SEC-SA the risk weight RW_{SA} is calculated by the following formulas (CRR, 2024, Art. 261(1)):

$$RW_{SA} = 1,250\% \qquad \text{when } D \leq K_A \tag{5}$$

$$RW_{SA} = 12.5 * K_{SSFA(K_A)} \qquad \text{when } A \geq K_A \tag{6}$$

$$RW_{SA} = \frac{K_A - A}{D - A} * 12.5 + \frac{D - K_A}{D - A} * 12.5 * K_{SSFA(K_A)} \qquad \text{when } A < K_A < D \tag{7}$$

where K_A is the hypothetical risk weight of the non-securitized underlying pool, calculated by the standardized approach (K_{SA}) and adjusted for defaults, multiplied by 8%. K_{SA} is adjusted for the nominal share of the underlying pool in default (W) as follows (CRR, 2024, Art. 261(2)):

$$K_A = (1 - W) * K_{SA} + W * 0.5 \tag{8}$$

8% is the required ratio of total capital to RWA without any capital buffers (CRR, 2024, Art. 92(1)c). Thus, K_A is equivalent to the capital requirements for the underlying pool under the

standardized approach, with the capital ratio for exposures in default set to 50% instead of 8%.

The general idea behind the Basel capital requirements is to absorb unexpected losses that occur in adverse scenarios (Basel Committee on Banking Supervision, 2005). In the standardized approach for credit risk, the technical implementation of this concept is less obvious than in the 99.9%-Value at Risk method of the IRB approach (see section IV.3.4.1). Nevertheless, K_A can be interpreted as the unexpected loss of the underlying pool in an adverse scenario. If K_A is greater than the detachment point D, the unexpected loss exceeds the detachment point of the tranche, resulting in a complete loss of capital under the same adverse scenario. This explains why this constellation requires a risk weight of 1,250% (see equation 5), which essentially means that the entire exposure must be covered by equity.

Applying the same logic, the unexpected loss of a securitization tranche would be zero when K_A is less than A. Therefore, this constellation requires a different method of risk weight calculation. Instead of using the unexpected loss of the underlying exposure directly, K_A is converted to a new parameter $K_{SSFA(KA)}$, which is then multiplied by 12.5 (see equation 6). When K_A is between A and D, RW_{SA} is determined by linear interpolation between 1,250% and $K_{SSFA(KA)}$ multiplied by 12.5 (see equation 7). Regardless of the relation between K_A, A and D, RW_{SA} is subject to a floor of 15% (CRR, 2024, Art. 261(1)).

In the following, I will discuss the factors influencing $K_{SSFA(K_A)}$ and thus RW_{SA}. $K_{SSFA(K_A)}$ is defined by the following equation (CRR, 2024, Art. 261(1)):

$$K_{SSFA(K_A)} = \frac{e^{a*u} - e^{a*l}}{a * (u - l)} \tag{9}$$

where

$$a = -\frac{1}{K_A} \tag{10}$$

$$u = D - K_A \tag{11}$$

$$l = max(A - K_A; 0) \tag{12}$$

In addition to K_A, $K_{SSFA(K_A)}$ also depends on the attachment point A and the detachment point D. For all senior tranches, D is equal to one, as there is no higher ranked tranche whose

balance is subtracted in the numerator (see equation 3). Thus, u becomes $1 - K_A$ and D isn't a relevant parameter for senior tranches. For non-senior tranches, D is the sum of A and the tranche thickness T. Since A is a separate parameter, it is easier to remove D from the equation and instead consider A and T as factors influencing $K_{SSFA(K_A)}$. Therefore, equation 11 is rewritten as follows:

$$u = A + T - K_A \tag{13}$$

To find the relationship between RW_{SA} and the economic parameters A, D and K_A (and thus K_{SA} and W), it is necessary to discover their influence on the equation parameters a, u and l. In the next step, the influence of A, D and K_A on $K_{SSFA(K_A)}$ can be derived from the connection of $K_{SSFA(K_A)}$ to a, u and l.

Equation 10 indicates a strictly positive relationship between a and K_A as the denominator of the negative quotient increases along with K_A. In addition, a must be less than -1 since it approaches -1 as K_A approaches 1, which would be equivalent to an unexpected loss of the entire underlying exposure. Parameter u is positively related to A and T and negatively related to K_A (see equation 13). Moreover, the range of u is from 0 to 1, as $A + T$, which also ranges from 0 to 1, is greater than K_A for all values where $K_{SSFA(K_A)}$ is used to determine RW_{SA}. l has a positive relationship with A and a negative relationship with K_A (see equation 12). As with u, the values for l are between 0 and 1 because this is the range for the values for A and the floor of 0 prevents l from becoming negative. In addition, l must be less than u, since tranche thickness T is always positive.

Since u is greater than l and a is a negative number, $a*u$ is a more negative exponent than $a*l$. Therefore, e^{a*u} is less than e^{a*l} and the numerator of $K_{SSFA(K_A)}$ is negative (see equation 9). For the same reason, $u - l$ is positive and the denominator becomes negative through multiplication by a. Because both the numerator and the denominator are negative, $K_{SSFA(K_A)}$ is positive, which is intuitively expected as negative risk weights and capital requirements wouldn't make sense.

To analyze the influence of a, u and l on $K_{SSFA(K_A)}$, it is necessary to differentiate equation 9 with respect to all three parameters. The first derivative of $K_{SSFA(K_A)}$ with respect to l is as

follows:

$$K_{SSFA(K_A)}{}'(l) = \frac{-a * e^{a*l} * a * (u-l) - (-a) * (e^{a*u} - e^{a*l})}{(a * (u-l))^2} \tag{14}$$

Rewriting and simplifying results in the following equations:

$$K_{SSFA(K_A)}{}'(l) = \frac{-a^2 * e^{a*l} * (u-l) + a * (e^{a*u} - e^{a*l})}{a^2 * (u-l)^2} \tag{15}$$

$$K_{SSFA(K_A)}{}'(l) = \frac{a * (-a * e^{a*l} * (u-l) + e^{a*u} - e^{a*l})}{a^2 * (u-l)^2} \tag{16}$$

$$K_{SSFA(K_A)}{}'(l) = \frac{-a * e^{a*l} * (u-l) + e^{a*u} - e^{a*l}}{a * (u-l)^2} \tag{17}$$

Since a is negative and $(u-l)^2$ is positive, the denominator of equation 17 is negative. The numerator can be rewritten like this:

$$Num = e^{a*l} * (e^{a*u-l} - 1 - a * (u-l)) \tag{18}$$

Replacing $a * (u-l)$ with x simplifies equation 18 to

$$Num = e^{a*l} * (e^{x} - 1 - x) \tag{19}$$

e^{a*l} is positive as e is greater than 0. e^x is greater than $x+1$ for all x values except 0, which isn't a valid value for $a * (u-l)$. Therefore, $e^x - 1 - x$ and the entire equation 19 are positive. Since the denominator of equation 17 is negative, $K_{SSFA(K_A)}{}'(l)$ is negative for all possible values of a, u and l, indicating a negative relationship between $K_{SSFA(K_A)}$ and l.

Continuing with u, the first derivative is as follows:

$$K_{SSFA(K_A)}{}'(u) = \frac{a * e^{a*u} * a * (u-l) - a * (e^{a*u} - e^{a*l})}{(a * (u-l))^2} \tag{20}$$

which can be rewritten as

$$K_{SSFA(K_A)}{}'(u) = \frac{a^2 * e^{a*u} * (u-l) - a * (e^{a*u} - e^{a*l})}{a^2 * (u-l)^2} \tag{21}$$

$$K_{SSFA(K_A)}{}'(u) = \frac{a * (a * e^{a*u} * (u-l) - (e^{a*u} - e^{a*l}))}{a^2 * (u-l)^2} \tag{22}$$

$$K_{SSFA(K_A)}{}'(u) = \frac{a * e^{a*u} * (u-l) - (e^{a*u} - e^{a*l})}{a * (u-l)^2} \tag{23}$$

Since the denominators in equations 17 and 23 are identical, they both have a negative sign. The numerator can be transformed into the following equations:

$$Num = a * e^{a*u} * (u-l) - e^{a*u} + e^{a*l} \tag{24}$$

$$Num = e^{a*u} * (a * (u-l) - 1) + e^{a*l} \tag{25}$$

$$Num = e^{a*l} * e^{a*(u-l)} * (a * (u-l) - 1) + e^{a*l} \tag{26}$$

$$Num = e^{a*l} * (e^{a*(u-l)} * (a * (u-l) - 1) + 1) \tag{27}$$

As with equation 18, replacing $a * (u-l)$ with x results in a simplified version of equation 27:

$$Num = e^{a*l} * (e^x * (x-1) + 1) \tag{28}$$

Because the global minimum of $e^x * (x-1)$ is at $(0, -1)$, $e^x * (x-1) + 1$ is positive for all x values except for 0. Since e^{a*l} is positive as well, equation 28 is positive. Thus, in combination with the negative denominator of equation 23, $K_{SSFA(K_A)}{}'(u)$ is negative for all possible values of a, u and l. Therefore u, like l, is negatively related to $K_{SSFA(K_A)}$.

As attachment point A is positively related to both u and l, an increase in A is associated with a decrease in $K_{SSFA(K_A)}$. This relationship makes economic sense, as a tranche becomes less risky if the threshold at which losses in the underlying pool start to be allocated to the tranche is higher. In addition, an increase in tranche thickness T is associated with a decrease in $K_{SSFA(K_A)}$, as T is positively related to u. The inverse relationship between $K_{SSFA(K_A)}$ and T reflects the fact that, ceteris paribus, a higher T is associated with a lower tranche LGD due to an increased loss absorption capacity after the default threshold A has been reached.

Finally, the first derivative of $K_{SSFA(K_A)}$ with respect to a is defined by the following equation:

$$K_{SSFA(K_A)}{}'(a) = \frac{(u * e^{a*u} - l * e^{a*l}) * a * (u - l) - (u - l) * (e^{a*u} - e^{a*l})}{(a * (u - l))^2} \tag{29}$$

As its entire term is in squared parentheses, the denominator of equation 29 is positive. The numerator can be rewritten as follows:

$$Num = (u - l) * ((u * e^{a*u} - l * e^{a*l}) * a - (e^{a*u} - e^{a*l})) \tag{30}$$

$$Num = (u - l) * ((a * u * e^{a*u} - a * l * e^{a*l}) - (e^{a*u} - e^{a*l})) \tag{31}$$

$$Num = (u - l) * (a * u * e^{a*u} - a * l * e^{a*l} - (e^{a*u} - e^{a*l})) \tag{32}$$

$$Num = (u - l) * ((a * u - 1) * e^{a*u} - (a * l - 1) * e^{a*l}) \tag{33}$$

Equation 33 can be simplified by replacing $a * u$ with x_1 and $a * l$ with x_2:

$$Num = (u - l) * (e^{x_1} * (x_1 - 1) - e^{x_2} * (x_2 - 1)) \tag{34}$$

The term in the first parentheses is positive as u is greater than l. Both x_1 and x_2 are negative because a, unlike u and l, is negative. Since u is greater than l, x_1 is less (i.e. more negative) than x_2. As $e^x * (x-1)$ is strictly decreasing for negative x values, $e^{x_1} * (x_1 - 1)$ must be greater than $e^{x_2} * (x_2 - 1)$. Thus, the term in the second parentheses is also positive. Because equation 34 and the denominator of equation 29 are both positive, $K_{SSFA(K_A)}$ is positive for all possible values of a, u and l. Hence, A is positively related to $K_{SSFA(K_A)}$.

The signs of the relations to $K_{SSFA(K_A)}$ and K_A are identical for all three parameters $a(+)$, $u(-)$ and $l(-)$ Therefore, $K_{SSFA(K_A)}$ increases as K_A increases. K_A itself is a combination of the hypothetical risk weight of the non-securitized underlying pool K_{SA} and the proportion of the exposure in default W. Thus, in line with economic intuition, higher hypothetical risk weights and proportions of defaulted loans in the underlying are associated with a higher risk weight of the securitization tranche under the SEC-SA.

IV.3.3.2 Graphical approach

Having determined the direction of the relationship between KSA, W, A and T to $K_{SSFA(K_A)}$ and thus RW_{SA}, the next part of this section deals with the effect size of the four parameters. To do so, I conduct ceteris paribus analyses for each parameter, fixing all remaining parameters at a level, that they have in a typical CLO. The sensitivity analyses are applied to the senior and class C mezzanine tranches of the typical CLO from Martin and Sayrak (2022) (see Table IV.4). Assuming that the balance of the underlying pool equals the balance of all securitization tranches, the attachment point A is 0.37 (100%-63%) for the senior tranche and 0.19 (8%+1%+5%+5%) for the class C tranche. For the sensitivity analysis, the range of possible values for A is set from 0.1 to 0.6.

The tranche thickness T is equivalent to the tranche's share of the securitization's total balance, which is 0.63 for the senior tranche and 0.06 for the class C tranche. The parameter T in the sensitivity analysis of A is the only case where a parameter other than the one being analyzed is not fixed at the typical CLO (tranche) level. This is because T has to be $1 - A$ in any senior tranche by definition. Thus, for the senior tranche, T is not a standalone parameter but functionally dependent on A. For the same reason, there is no RW_{SA} sensitivity analysis of T for the senior tranche. For the class C tranche, the sensitivity analysis considers values of T between 0.05 and 0.2.

K_{SA} is the hypothetical risk weight of the non-securitized underlying under the standardized approach on credit risk multiplied by 0.08. Under this approach, there are four different risk weights for exposures to corporates based on their credit quality step (CRR, 2024, Art.122). Annex III of Commission Implementing Regulation (EU) 2016/1799 (European Commission, 2016a) assigns agency ratings to the corresponding credit quality steps. The underlying of CLOs consists of leveraged loans, which by common definition are rated BB+ or worse (S&P Global Inc., 2020). Under the standardized approach, the risk weight for corporate exposures is 100% if the rating letter is BB (i.e., the rating is between BB+ and BB-) and 150% if the rating letter is B+ or worse. Hence, K_{SA} of a CLO is determined by the proportion of underlying loans with a BB rating letter.

For the typical European CLO, it is reasonable to assume that the share of BB loans is equivalent to their proportion in the European leveraged loan market. This proportion is estimated by calculating the ratio of the market values of the Morningstar European BB Ratings Loan Index and the Morningstar European Leveraged Loan Index.[5] The average of this ratio was 18% between 2002 and 2020. Assuming a risk weight of 150% for the remaining 82% of loans, the underlying of a typical CLO would have a risk weight of 141% $(0.82 * 150\% + 0.18 * 100\%)$ under the standardized approach. Multiplying this value by 0.08 results in a K_{SA} of 0.1128. For the sensitivity analysis, we consider K_{SA} values between 0.08 and 0.12. The lower limit of this range implies a CLO whose underlying consists entirely of loans with a rating letter of BB. The upper limit implies a CLO with only B+ or worse rated underlying loans.

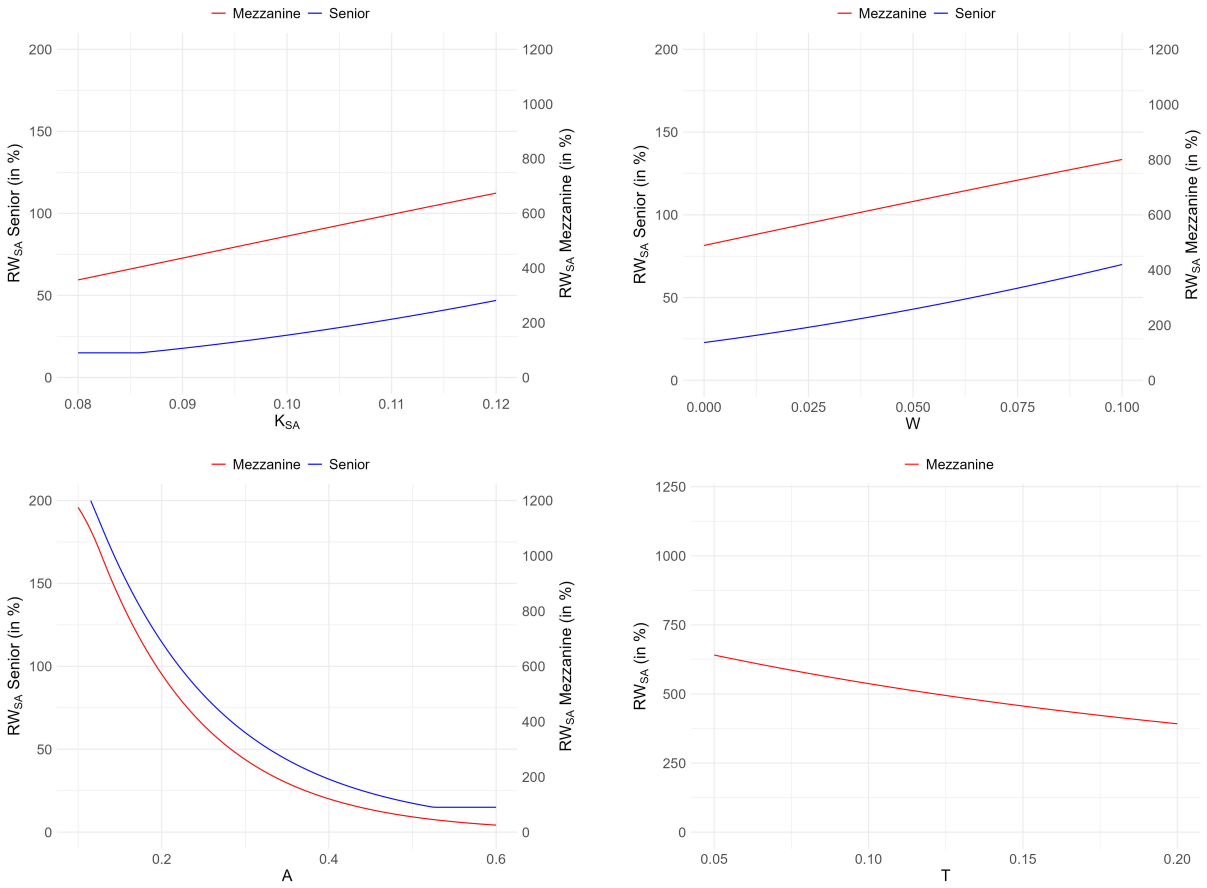
The available data on leveraged loan default rates typically refer to the loan amount that defaulted during the past 12 months as a proportion of the total outstanding amount at the beginning of this period (e.g., S&P Global Inc., 2025). However, the share of loans in default W also depends on the resolution time, for which there is little data available. On the S&P scale, a D rating corresponds to defaulted credit. Thus, the proportion of D rated loans in the leveraged loan index is a plausible estimate for the share of defaulted loans in a typical CLO. Unfortunately, the proportion of D rated loans isn't available for the Morningstar European Leveraged Loan Index. However, in the Morningstar LSTA US Leveraged Loan Index, the average par value-weighted share of loans with a rating of D among all rated loans between 1997 and 2020 was 4.03%. Therefore, 0.0403 is used as an estimate of W in the typical CLO. The sensitivity analysis considers W values ranging from 0 to 0.1.

Figure IV.1 presents the results of the RW_{SA} sensitivity analysis for all four parameters. The scale on the left-hand side shows RW_{SA} for the senior tranche, while the scale on the right-hand side refers to the class C mezzanine tranche. Of the four parameters, attachment point A shows the widest range of RW_{SA}, underlining the importance of loss absorption through lower-ranked tranches. While RW_{SA} of senior tranches with an A of 0.53 or more (i.e., a thickness T of 0.47

[5]The Morningstar Leveraged Loan Index family (formerly known as the S&P Leveraged Loan Index family) uses data from PitchBook Leveraged Commentary & Data (LCD) to cover the development of the Leveraged Loan market. I have access to LCD data up to 2020. For detailed information on the construction of the Morningstar Leveraged Loan Indexes, see Morningstar Inc. (2025).

or less) doesn't exceed the floor of 15%, thick senior tranches with an A of 0.2 (i.e., a T of 0.8) have an RW_{SA} of 115%.

Figure IV.1: These graphs illustrate the sensitivity of RW_{SA} to ceteris paribus changes in SEC-SA parameters for a typical senior and class C mezzanine tranche. The parameters are fixed at the following values for all graphs except the one showing their relation to the RW_{SA}: K_{SA}: 0.1128; W: 0.0403; A: 0.37 (senior) and 0.19 (mezzanine); T: 0.63 (senior) and 0.06 (mezzanine). The only exception is the value for the parameter T in the graph showing the RW_{SA} sensitivity to A, which is set to $1 - A$ for the senior tranche. All parameters are explained in appendix Table IV.A.1



In general, the SEC-SA results in much higher risk weights for a typical CLO than the SEC-ERBA. For the typical CLO, RW_{SA} of the senior tranche is 38.5% compared to an RW_{ERBA} of 20% (see Table IV.4 for comparison). For the class C tranche, the disparity increases to an RW_{SA} of 618% and an RW_{ERBA} of 169%. However, while RW_{SA} remains high for the class C tranche, it decreases to the 15% floor for a senior tranche with a low hypothetical risk weight of its underlying K_{SA} or a high attachment point A (i.e., a relatively thin senior tranche). In addition, even with typical K_{SA} and A values, the senior tranche of a CLO without any

underlying loans in default (i.e., a W of 0) has a similar RW_{SA} (22.8%) and RW_{ERBA} (20%).

IV.3.4 SEC-IRBA

IV.3.4.1 Analytical approach

The structure of the SEC-IRBA formula for the risk weight RW_{IRBA} is identical to that of the formula for RW_{SA} (see equations 5, 6 and 7 for comparison). The only differences are that K_{IRB} replaces K_A and $K_{SSFA(K_{IRB})}$ replaces $K_{SSFA(K_A)}$ (CRR, 2024, Art. 259(1)):

$$RW_{IRBA} = 1,250\% \qquad \text{when } D \leq K_{IRB} \tag{35}$$

$$RW_{IRBA} = 12.5 * K_{SSFA(K_{IRB})} \qquad \text{when } A \geq K_{IRB} \tag{36}$$

$$RW_{IRBA} = \frac{K_{IRB} - A}{D - A} * 12.5 + \frac{D - K_{IRB}}{D - A} * 12.5 * K_{SSFA(K_{IRB})} \qquad \text{when } A < K_{IRB} < D \tag{37}$$

As with RW_{SA}, RW_{IRB} is subject to a floor of 15% (CRR, 2024, Art. 259). Like K_A, K_{IRB} is the hypothetical risk weight of the underlying exposure if it hadn't been securitized, multiplied by 8%. However, instead of the standardized approach, the IRB approach to credit risk is used to determine K_{IRB} (CRR, 2024, Art. 255).

Under the IRB approach to credit risk, the risk weight of a corporate loan is determined by the following formula (CRR, 2024, Art. 153):

$$\begin{aligned} Risk\ Weight = &(LGD * N(\frac{1}{\sqrt{1-R}} * G(PD) + \sqrt{\frac{R}{1-R}} * G(0.999)) - LGD * PD) \\ &* \frac{1 + (M_L - 2.5) * b}{1 - 1.5 * b} * 12.5 * 1.06 \end{aligned} \tag{38}$$

where $N(x)$ is the cumulative distribution function for a standard normal random variable. $G(z)$ is the inverse cumulative distribution function for a standard normal random variable. PD is the loan's probability of default at a one-year horizon. LGD is the loss given default of the loan. M_L is the loan maturity as defined in Article 162 of CRR (2024) and the parameters

R and b are determined by the following equations:

$$R = 0.12 * \frac{1 - e^{-50*PD}}{1 - e^{-50}} + 0.24 * (1 - (\frac{1 - e^{-50*PD}}{1 - e^{-50}}) \tag{39}$$

$$b = (0.11852 - 0.05478 * ln(PD))^2 \tag{40}$$

The concept behind the IRB formula is described in detail in Basel Committee on Banking Supervision (2005). The basic idea is that a bank must have enough capital to absorb the unexpected loss that occurs in the 99.9th percentile of adverse scenarios. In other words, the bank's capital must be greater than or equal to the 99.9% value at risk of the bank's loan portfolio. The IRB approach is based on the assumption that the development of a company's asset value and thus the default of its outstanding loans, depends on two risk factors - one systemic and one idiosyncratic. If the portfolio weight of each loan becomes small enough, the idiosyncratic risks of the loans cancel each other out. Therefore, the portfolio loss depends entirely on the systemic risk factor and can be described as the sum of the conditional expected loss of each loan in the portfolio. In this context, the conditional expected loss is the expected loss of a loan given a specific outcome of the systemic risk factor.

Therefore, if a bank's capital must exceed the portfolio losses on the 99.9th percentile of adverse scenarios, the capital requirements for each loan have to be based on its conditional expected loss on the same percentile of negative outcomes of the systemic risk factor. The following part of the formula describes the conditional expected loss on the 99.9th percentile:

$$LGD * N(\frac{1}{\sqrt{1-R}} * G(PD) + \sqrt{\frac{R}{1-R}} * G(0.999)) \tag{41}$$

where the $N(x)$ term that is multiplied by the LGD, describes the conditional PD on the 99.9th percentile of adverse outcomes of the systemic risk factor. As the Basel Committee on Banking Supervision (2005) considers the expected loss as a regular cost component that is included in the bank's credit pricing, only the unexpected loss must be covered by capital. Thus, the (unconditional) expected loss ($LGD * PD$) is subtracted from the conditional expected loss in the calculation of capital requirements.

As PD has a horizon of 1 year and the maturity is positively related to a loan's default risk, the factor $(1+(M_L-2.5)*b)/(1-1.5*b)$ adjusts the capital requirements for longer maturities. The requirements for a bank's total capital without any capital buffers are defined as 8% of the bank's RWA (CRR, 2024, Art.92(1)c). Therefore, the capital requirements as a proportion of the exposure value must be multiplied by 12.5 to determine the risk weight of a loan. Finally, the scaling factor of 1.06 was determined with the introduction of the IRB approach in order to broadly maintain the aggregated level of capital requirements, while simultaneously incentivizing the use of the IRB (Basel Committee on Banking Supervision, 2005).

The value-weighted average recovery rate of defaulted loans between 1987 and 2023 was 67.6% Gunter and Kraemer (2023). Applying the formula $1 - Avg.\ Recovery\ Rate$ yields an LGD estimate of 0.324. There is limited data on the average maturity of leveraged loans. However, Article 162 of the CRR (2024) defines 2.5 years as the standard value of M_L for corporate exposures. Substituting these two values into equation 38 results in the following formula:

$$\begin{aligned} Risk\ Weight =& (0.324 * N(\frac{1}{\sqrt{1-R}} * G(PD) + \sqrt{\frac{R}{1-R}} * G(0.999)) - 0.324 * PD) \\ & * \frac{1}{1-1.5*b} * 12.5 * 1.06 \end{aligned} \tag{42}$$

To calculate K_{IRB}, the risk weight of the underlying must be multiplied by 8%, which reduces the factor of 12.5 from equation 42. Hence, $K_{IRB}(PD_U)$ can be calculated by the following equation:

$$\begin{aligned} K_{IRB}(PD_U) =& (0.324 * N(\frac{1}{\sqrt{1-R}} * G(PD_U) + \sqrt{\frac{R}{1-R}} * G(0.999)) - 0.324 * PD_U) \\ & * \frac{1}{1-1.5*b} * 1.06 \end{aligned} \tag{43}$$

where PD_U is the uniform PD of all loans in the underlying pool.[6]

Under the SEC-IRBA, the connection between K_{SSFA} and a, u and l is the same as under

[6]In reality, PD differs between the individual loans in the underlying pool. The relationship between PD and IRB risk weight is concave (Behn et al., 2022). Therefore, using the portfolio average as PD in equation 42 would result in an overestimate of a loan portfolio's risk weight. For the same reason, using the average PD of the underlying pool for PD_U would result in an overestimate of K_{IRB}.

the SEC-SA (CRR, 2024, Art.259(1)):

$$K_{SSFA(K_{IRB})} = \frac{e^{a*u} - e^{a*l}}{a*(u-l)} \tag{44}$$

Therefore, $K_{SSFA(K_{IRB})}$ must also be negatively related to u and l and positively related to a (see section IV.3.3.1). Except for K_{IRB} replacing K_A, the parameters u and l are defined identically as in the $K_{SSFA(K_{SA})}$ formula (see equations 11 and 12). Hence, T (for non-senior tranches) and A are positively related to $K_{SSFA(K_{IRB})}$ and thus RW_{IRBA}.

However, in comparison to $K_{SSFA(K_A)}$, the parameter a of the $K_{SSFA(K_{IRB})}$ formula includes an additional factor p in the denominator (CRR, 2024, Art. 259(1)):

$$a = -\frac{1}{p*K_{IRB}} \tag{45}$$

For senior (p_{sen}) and non-senior ($p_{non\text{-}sen}$) tranches p is calculated as follows:

$$p_{sen} = max(0.3; 3.56*\frac{1}{N} - 1.85*K_{IRB} + 0.55*LGD + 0.07*M_T) \tag{46}$$

$$p_{non\text{-}sen} = max(0.3; 0.16 + 2.87*\frac{1}{N} - 1.03*K_{IRB} + 0.21*LGD + 0.07*M_T) \tag{47}$$

where N is the effective number of exposures defined as $(\sum_i EAD_i)^2 / \sum_i EAD_i^2$ (CRR, 2024, Art. 259(4)). LGD is the value-weighted average LGD of the underlying pool and M_T is the tranche maturity as defined in section IV.3.2. Using the LGD estimate of 0.324 derived from Gunter and Kraemer (2023), results in the following equations for p:

$$p_{sen} = max(0.3; 3.56*\frac{1}{N} - 1.85*K_{IRB} + 0.55*0.324 + 0.07*M_T) \tag{48}$$

$$p_{non\text{-}sen} = max(0.3; 0.16 + 2.87*\frac{1}{N} - 1.03*K_{IRB} + 0.21*0.324 + 0.07*M_T) \tag{49}$$

The factor p is positively related to a, as the denominator of the negative quotient increases with p (see equation 45). Since an increase in a is associated with an increase in $K_{SSFA(K_{IRB})}$, parameters that are positively related to p also have a positive relationship with $K_{SSFA(K_{IRB})}$

and thus RW_{IRBA}. Hence, as M_T is an addend, an increase in M_T is associated with an increase in RW_{IRBA}. This is consistent with both economic intuition and the effect of M_T on RW_{ERBA} (see section IV.3.2).

In contrast, N is negatively related to p as it is in the denominator of an addend. As described above, K_{IRB} is based on the IRB risk weight formula, which implies a level of portfolio diversification that is large enough to make the idiosyncratic risk factor irrelevant (Basel Committee on Banking Supervision, 2005). Adjusting p for the effective number of exposures N ensures that the idiosyncratic risk of the underlying pool is considered in the calculation of RW_{IRBA}. The fact that a higher number of loans leads to greater diversification and thus a reduction in idiosyncratic risk is reflected by the negative effect of N on RW_{IRBA}.

The denominator of equation 45 includes K_{IRB} twice. On the one hand, K_{IRB} is a separate factor that increases the negative denominator and thus a. On the other hand, the subtrahend $1.85 * K_{IRB}$ ($1.03 * K_{IRB}$ for non-senior tranches) creates a negative effect of K_{IRB} on a. If all factors of equations 46 and 47 except for the subtrahend involving K_{IRB} are replaced by b and 1.85 (1.03) is replaced by c in equation 46 (47), the formula defining p can be rewritten like this:

$$p = b - c * K_{IRB} \tag{50}$$

Inserting equation 50 for p results in the following denominator of equation 45

$$Den = (b - c * K_{IRB}) * K_{IRB} \tag{51}$$

which, after expanding the parenthesis, is written as

$$Den = b * K_{IRB} - c * {K_{IRB}}^2 \tag{52}$$

For small values, an increase in K_{IRB} results in an increase in the denominator. In contrast, for large values, the effect of ${K_{IRB}}^2$ in the subtrahend overcompensates the impact of K_{IRB} in the addend, resulting in an overall decrease in the denominator if K_{IRB} increases further. To determine the range of values where K_{IRB} is positively related to the denominator and thus to

a, it is necessary to differentiate equation 52 with respect to K_{IRB}.

$$Den'(K_{IRB}) = b - 2c * K_{IRB} \tag{53}$$

The global maximum ${K_{IRB}}^*$ of the denominator, where the effect of K_{IRB} reverses, is at the root of function 53:

$$b - 2c * {K_{IRB}}^* = 0 \qquad | + 2c * {K_{IRB}}^* \tag{54}$$

$$b = 2c * {K_{IRB}}^* \ | : 2c \tag{55}$$

$${K_{IRB}}^* = \frac{b}{2c} \tag{56}$$

Reusing the original multipliers of K_{IRB} from equations 46 and 47 instead of c results in the following formulas for KIRB of the senior and non-senior tranche.

$${K_{IRB;Sen}}^* = \frac{b}{2 * 1.85} \tag{57}$$

$${K_{IRB;Non-Sen}}^* = \frac{b}{2 * 1.03} \tag{58}$$

The calculation of b requires values for M_T and N. As in section IV.3.2, I assume an M_T of 5 for the typical CLO based on Kollmorgen and Kramer (2024). According to Kundu (2023), the median CLO portfolio consists of 287 loans. Assuming equal portfolio weights, N is 287 for the typical CLO.[7] Using these estimates for M and N results in the following values for b:

$$b_{sen} = 3.56 * \frac{1}{287} + 0.55 * 0.324 + 0.07 * 5 = 0.5406 \tag{59}$$

$$b_{non\text{-}sen} = 0.16 + 2.87 * \frac{1}{287} + 0.21 * 0.324 + 0.07 * 5 = 0.588 \tag{60}$$

[7] In reality, N is slightly less, as the result of function $(\sum_i EAD_i)^2 / \sum_i EAD_i^2$ is somewhat below the number of exposures if the exposure values aren't equally distributed. However, the number of exposures in the median CLO is used as an estimate of N as Kundu (2023) does not provide any information on the distribution of portfolio weights. In addition, the deviation of N from the number of exposures is limited for portfolio weight distributions in the expected range.

Substituting these parameters into equations 57 and 58 yields the following results for ${K_{IRB}}^*$:

$$ {K_{IRB;Sen}}^* = \frac{0.5406}{2 * 1.85} = 0.1461 \tag{61} $$

$$ {K_{IRB;Non-Sen}}^* = \frac{0.588}{2 * 1.03} = 0.2854 \tag{62} $$

The parameter p is subject to a floor of 0.3 (see equations 46 and 47). Thus, below this value, an increase in K_{IRB} isn't associated with a further decrease in p. Without considering the floor, ${K_{IRB}}^*$ is the critical value at which the negative effect of K_{IRB} on p begins to overcompensate its additive effect on the denominator of the negative quotient in equation 45. Therefore, K_{IRB} would have a positive relationship with a for the entire range of possible values if the floor of p were reached before the critical value ${K_{IRB}}^*$. Substituting ${K_{IRB}}^*$ for K_{IRB} along with the determined values of b and c in equation 50 gives the following corresponding p values p^*:

$$ {p_{sen}}^* = 0.5406 - 1.85 * 0.1461 = 0.2703 \tag{63} $$

$$ {p_{non\text{-}sen}}^* = 0.588 - 1.03 * 0.2854 = 0.294 \tag{64} $$

As p^* is less than the floor of 0.3 for both senior and non-senior tranches, K_{IRB} is positively related to a for the entire range of possible K_{IRB} values.

In the definition of parameters u and l, K_{IRB} is equivalent to K_A in the same parameters of $K_{SSFA(K_A)}$. Thus, K_{IRB} is also negatively related to both parameters (see section IV.3.3.1). As the relation of K_{IRB} to the three parameters $a(+)$, $u(-)$ and $l(-)$ has the same sign as the relation of these parameters to $K_{SSFA(K_{IRB})}$, K_{IRB} has a positive effect on $K_{SSFA(K_{IRB})}$. Since K_{IRB} increases with PD_U, $K_{SSFA(K_{IRB})}$ and thus RW_{IRBA} are positively related to the default risk of the underlying loans. The RW_{IRBA} increasing effect of PD_U reflects the basic economic principle that securitization investors ultimately bear the credit risk of the underlying loan pool.

IV.3.4.2 Graphical approach

Having established the nature of the parameters' PD, N, A, T and M_T effects on RW_{IRBA}, the paper continues by determining the effect sizes. The determination of effect sizes is conceptually

based on the same type of sensitivity analysis as used for the SEC-SA. Since the RW_{IRBA} sensitivities are analyzed for the senior and class C tranche of the same typical CLO as in section IV.3.3.2, the parameters A and T are identical regarding both their values used in the analyses of all other parameters (A: 0.37/0.19; T: 0.63/0.06)[8] and the ranges considered for their own sensitivity analyses (A: 0.1-0.6; T: 0.05-0.2).

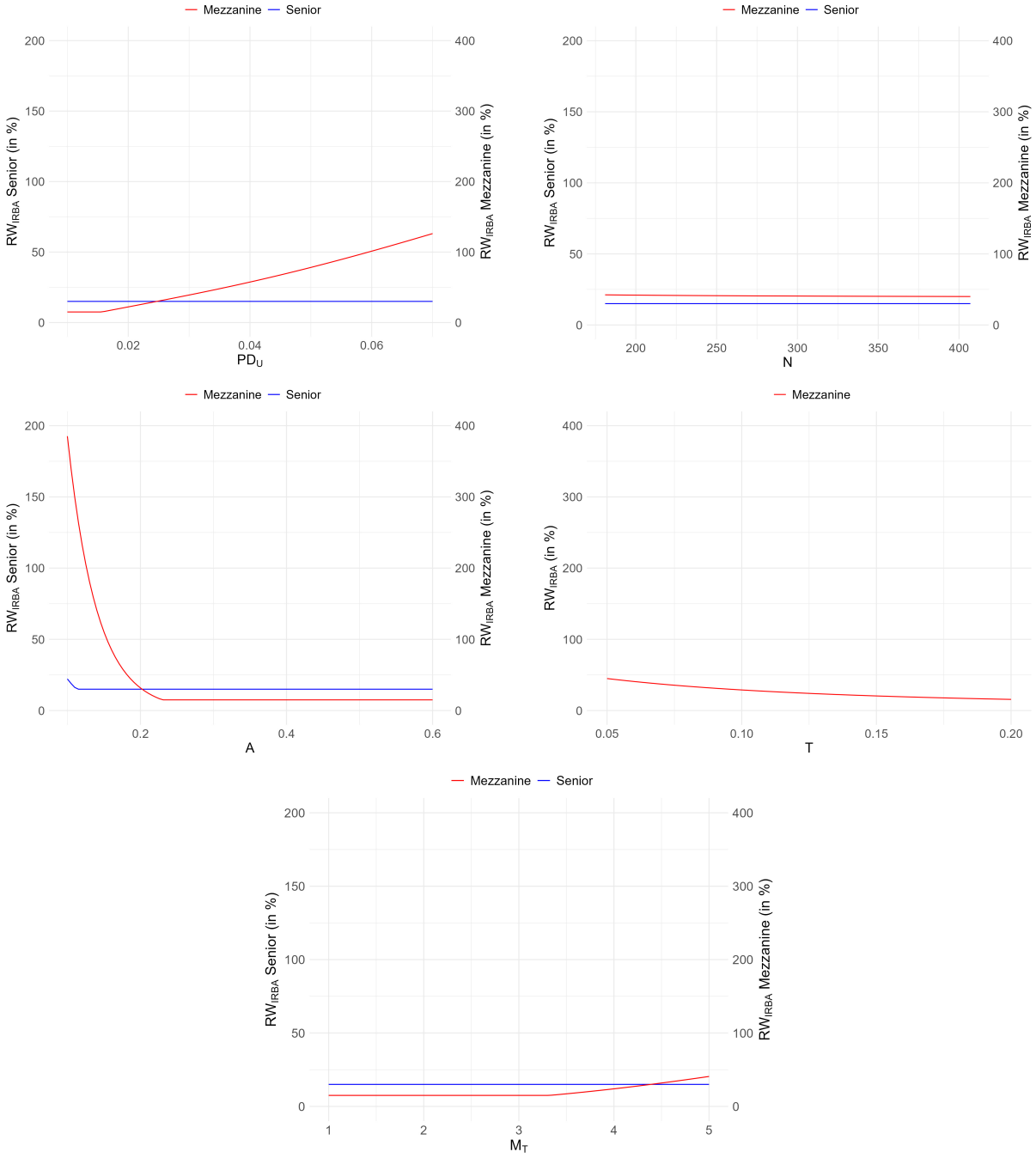
Under the assumption that, on average, ex-post default rates are equal to ex-ante default probabilities, PD_U can be derived from historical default rates with a time horizon of one year. The long-term average of the 12-month trailing default rate of European speculative grade issuers is 3.1% (S&P Global Inc., 2025). Assuming that the underlying loans of a typical European CLO are representative of the overall market of speculative grade issuers, this value is used as an estimate of PD_U. The sensitivity analysis considers PD_U values ranging from 1% to 7%.

As explained above, the estimate of N for a typical CLO is 287. In the sensitivity analysis, the 25th and 75th percentiles of the number of loans according to Kundu (2023) are used for the lower and upper limit of N. As a result, the observed range of N values starts at 181 and ends at 407. In accordance with section IV.3.2, M_T for the typical CLO is set to 5. In the sensitivity analysis of M_T, the full range of possible values between the legal floor and cap of 1 and 5 years is considered (CRR, 2024, Art. 257(2)).

Figure IV.2 shows the results of the sensitivity analyses of RW_{IRBA} to its five determining parameters mentioned above. For the typical CLO, RW_{IRBA} is much less than RW_{ERBA} and RW_{SA}. Using the fixed values for all parameters yields an RW_{IRBA} of 15% for the senior tranche and 40.8% for the class C tranche. This puts RW_{IRBA} for both tranches in the middle of the risk weights of the standardized and IRB approach before the framework revision. In comparison to the old IRB approach, the risk weights of both tranches have approximately doubled (see Table IV.2). Moreover, in four of the five sensitivity analyses, RW_{IRBA} of the senior tranche is at the 15% floor for the entire range of values. Only for extremely thick senior tranches with an attachment point A of 0.11 or less (i.e., a thickness T of at least 0.89) RW_{IRBA} exceeds its minimum value.

[8] T is set to $1 - A$ in the analysis of the RW_{IRBA} sensitivity of the senior tranche to A.

Figure IV.2: These graphs illustrate the RW_{IRBA} sensitivity to ceteris paribus changes in SEC-IRBA parameters for a typical senior and class C mezzanine tranche. The parameters are fixed at the following values for all graphs except the one showing their relation to the RW_{IRBA}: PD_U: 0.031; N: 287; A: 0.37 (senior) and 0.19 (mezzanine); T: 0.63 (senior) and 0.06 (mezzanine); M_T: 5. The only exception is the value for the parameter T in the graph showing the RW_{IRBA} sensitivity to A, which is set to $1 - A$ for the senior tranche. All parameters are explained in appendix Table IV.A.1



For non-senior tranches with T of 0.06 and otherwise typical CLO parameters, RW_{IRBA} is at the 15% floor for all values of A above 0.23. For the class B mezzanine tranche of a typical CLO, both the values of A (1-0.63-0.12=0.25) and T (0.12) exceed this threshold (see Table IV.4). Therefore, the two highest tranches of a typical CLO have both an RW_{IRBA} of 15%. Below the threshold for the RW_{IRBA} floor, a further decrease in A results in a very strong increase in RW_{IRBA}. If A decreases from 0.23 to 0.15, RW_{IRBA} increases from 15% to 110%, reflecting the important role of loss absorption by more senior tranches for the credit risk of securitizations.

Aside from A, PD_U has the widest range of values for RW_{IRBA} in the sensitivity analyses. If PD_U decreases to half of its typical value, RW_{IRBA} reaches the 15% floor for the typical class C tranche. On the other hand, a doubling of PD_U to 0.062 is associated with an approximately 2.5-fold increase in RW_{IRBA} to 106%. A doubling of T to 0.12 reduces RW_{IRBA} of the typical class C tranche from 40.8% to 25%. Variation in N has hardly any impact on RW_{IRBA} because a CLO with 181 positions is still diversified enough that the idiosyncratic risk is irrelevant for the calculation of RW_{IBRA}. As M_T falls below the value of 5 towards the end of the securitization's term, RW_{IRBA} of its tranches begins to decline. In the absence of large loan defaults, which would reduce A and T or a highly distressed underlying pool that would increase PD_U, RW_{IBRA} of a typical class C tranche reaches the 15% floor at M_T of 3.3 years. According to equation 1, this corresponds to a legal maturity of approximately 3.9 years.

IV.4 Impact of the framework revisions on CLO spreads

IV.4.1 Hypothesis development

Sections IV.2 and IV.3 suggest that the risk weights of typical CLOs have increased due to the revisions to the Basel securitization framework. Higher risk weights lead to higher capital requirements and thus higher funding costs for lending banks. If the bank sets interest rates with a constant margin, this leads to higher borrowing costs for creditors. A number of empirical studies in various settings confirm the interest rate-increasing effect of higher capital requirements.

In 2008, the implementation of the Basel II reforms in the UK resulted in both lower and differentiated risk weights of mortgages in comparison to the higher and uniform capital requirements under the Basel I regulation. Benetton et al. (2021) use a triple difference model to compare interest rates of UK mortgages with high and low loan-to-value, granted before and after the Basel II implementation by banks using the IRB and KSA approach for risk weight calculation. Their findings suggest that, based on the 8% ratio for total capital, a one percentage point decrease in capital requirements is associated with a 10-16 bp decline in mortgage rates.

Glancy and Kurtzman (2022) use an increase in risk weights for high volatility commercial real estate (HVCRE) loans implemented in the US in 2015 to examine the sensitivity of loan rates to capital requirements. After the implementation, loans that met the HVCRE criteria were subject to a risk weight of 150%, compared to the 100% that has been continuously used for commercial real estate loans without a HVCRE status. Following the implementation, interest rates on HVCRE loans increased by 34 bp relative to non-HVCRE commercial real estate loans, indicating an 8.5 bp increase in loan rates per percentage point increase in capital requirements (34 bp/((150%-100%)*0.08)).

The original CRR, which was implemented EU-wide in 2014, included a supporting factor for small and medium-sized enterprises (SME-SF), which reduced risk weights on credits to firms below a specific size by 23.8% (CRR, 2013, Art. 501). This factor wasn't included in the previous Italian regulation on capital requirements. di Patti et al. (2023) use a sample of lending relationships between Italian banks and firms to identify differences in the interest rates of SME- and non-SME firms before and after the implementation of the CRR. They find a relative 26 bp rate decrease for loans to firms subject to the SME-SF. Dividing this number by the 2 percentage point reduction in capital requirements results in an estimated effect of 13 bp lower interest rates per percentage point lower capital requirements.[9]

Using the midpoint of the 10-16 bp range in Benetton et al. (2021) results in an average estimate across the three papers of an 11.5 bp higher interest rate for each percentage point

[9]The 2 percentage point capital requirement reduction by the SME-SF is an approximation made by di Patti et al. (2023). Assuming a 100% risk weight for non-SME companies, the actual reduction is just over 1.9 percentage points (23.8%*0.08).

higher capital requirements ((13+13+8.5)/3). This corresponds to an approximately 0.9 bp increase in interest rates for each percentage point increase in risk weight (11.5 bp*0.08). In absolute terms, a one percentage point increase in capital requirements is equivalent to 1 USD of additional capital per 100 USD of outstanding loan volume. In combination with the 11.5 bp increase in interest rates, this means that banks are willing to add 1 USD of capital if they can increase their income by 11.5 cents.

Regarding securitizations, Stanton and Wallace (2018) provide some evidence for a negative relationship between risk weight and interest rates. They examine a regulatory change in the US in 2002 that reduced the risk weight of highly rated commercial mortgage-backed securities (CMBS), while leaving the risk weight of low-rated CMBS tranches unchanged. Following the regulatory change, the yield of AAA- and AA-rated CMBS declined relative to non-securitized corporate bonds with the same rating. In contrast, the yield spread between low-rated CMBS and equally rated corporate bonds remained stable throughout the entire period. However, as the focus of the paper is on the adjustment of rating agencies to the regulatory change, Stanton and Wallace (2018) provide only a graphical illustration of the relative interest rate changes and no descriptive data on the effect size (e.g., the average yield spreads between corporate bonds and equally rated CMBS tranches for different rating categories before and after 2002).

Another strand of literature uses other measures than loan interest rate changes to examine the cost of regulatory capital for banks. Kisin and Manela (2016) exploit a regulatory loophole that existed before the financial crisis. At that time, the credit conversion factor (CCF) for liquidity guarantees provided to (ABCP) conduits was set to only 10% of the equivalent credit exposure amount. This allowed institutions to effectively hold the risk of the underlying assets with a 90% discount on capital requirements (Acharya et al., 2013). The spread between ABCPs and commercial papers with similar risk indicates that banks are willing to give up less than one cent of earnings to avoid one dollar of additional capital requirements. Kisin and Manela (2016) attribute this almost negligible figure to a large difference between regulatory and economic capital ratios, caused by banks' ability to bypass regulation. Based on an equilibrium model, the authors conclude that economic capital requirements increase by only 10% of an increase in regulatory requirements.

Plosser and Santos (2024) use undrawn fees of credit lines to estimate the relationship between capital requirements and the pricing by banks. Implemented in the US in 1992, Basel I introduced a CCF of 50% for undrawn credit lines with maturities of more than one year and 0% for undrawn lines of credit with maturities of up to one year. Using relative price changes after the implementation, the authors conclude that banks are willing to give up 1.63 cents of income from undrawn fees to avoid one additional USD of capital requirements.

However, unlike the three papers that analyze loan rates, Plosser and Santos (2024) base their calculation on the 4% ratio used for tier 1 capital. In addition, they include a marginal corporate tax rate of 35% in their calculation. Employing the same approach as in the three loan rate papers, the 5 bp relative reduction in undrawn fees of credit lines with less than one year maturity would result in 1.3 bp lower fees per percentage point lower capital requirements (5 bp/(50%*0.08)). These results are broadly consistent with the very small cost of regulatory capital found by Kisin and Manela (2016) and in contrast with the much larger effects observed in the three papers using difference-in-difference analysis of loan interest rates.

Previous empirical studies have focused on non-securitized loans or credit lines, for which banks are the main capital providers. However, in securitizations such as CLOs, institutional investors account for a large fraction of the capital provision. A significant increase in the interest rate of a CLO tranche due to tighter bank capital requirements would only be expected if banks account for a sufficiently large share of investments in this tranche category. Table IV.5 presents the composition of investor groups in European CLO tranches by rating, as reported in Kollmorgen and Kramer (2024). Banks are the largest investor group in AAA-rated tranches, accounting for almost half of the capital. For all other tranches, the share of banks in the invested capital is very small, not exceeding 10% in any of the remaining rating categories.

In the majority of CLOs, only the senior tranche is AAA-rated. However, there are some CLOs with at least one AAA mezzanine tranche. European Central Bank (2019) shows the market share of investor groups separately for AAA senior tranches and AAA mezzanine tranches of European CLOs. Unfortunately, the report doesn't provide exact values for the bar chart that is used to visualize the investor shares. However, the approximate share of banks in the capital of AAA senior tranches is 40%, compared to just under 20% for AAA mezzanine tranches. For

Table IV.5: This table provides an overview of the composition of investor groups in European CLO tranches by rating. The data is taken from Kollmorgen and Kramer (2024), who obtained it from Bank of America Global Research.

Rating	Banks	Pens. Funds & Ins.	Asset Managers	Hedge Funds etc.
AAA	49%	7%	42%	2%
AA	10%	13%	69%	8%
A	10%	20%	63%	6%
BBB	6%	16%	66%	13%
BB	8%	10%	56%	27%
B	5%	7%	45%	43%

all other tranche types, the share of bank investors is below 10%, confirming the results in Kollmorgen and Kramer (2024). Reflecting these findings, there are two reasonable definitions for bank tranches of a CLO. Under the narrow definition, only AAA-rated senior tranches are bank tranches. In contrast, the broad definition includes all AAA-rated tranches, regardless of seniority. Under both definitions, all other tranches are considered as non-bank tranches.

Calculations based on the typical CLO structure from Martin and Sayrak (2022) indicate a higher risk weight after the implementation of the securitization framework. To substantiate the hypothesis of higher risk weights and thus higher interest rates, I calculate the risk weights of bank tranches of European CLOs by narrow and broad definition with pricing dates after December 12, 2017, the adoption date of Regulation (EU) 2017/2401 (European Parliament and Council, 2017). I use data from Creditflux's CLO-i database to calculate the risk weights.

CLO-i provides data on CLO capital structures, including the tranches' pricing and maturity dates, balance values, seniority and ratings. In addition, CLO-i provides data on accounting values, ratings and default status of the underlying loans. These data allow for the calculation of RW_{ERBA} and RW_{SA}. RW_{IRBA} can't be determined because of the lack of information on the PD values of the underlying loans from banks' internal rating systems that are necessary for the calculation of K_{IRB}. I have access to CLO-i data until 2020. As the most recent CLOs in the sample have pricing dates in September, the observation period covers 2 years and 9 months after the implementation of Regulation (EU) 2017/2401 (European Parliament and Council, 2017).

CLO-i covers 168 European CLOs with pricing dates between December 12, 2017 and September 2020 with AAA-rated senior tranches. CLOs where the senior tranche isn't AAA-

rated are excluded as I have no information on the role of banks as investors for these tranches. In addition, these 168 CLOs have 31 AAA-rated (i.e., bank tranches) non-senior tranches, reflecting the fact that AAA ratings are rather atypical except for the senior tranche.

Table IV.6 presents the distributions of RW_{ERBA} and RW_{SA}, along with the parameters involved in their calculation, for bank tranches with a pricing date after the implementation of Regulation (EU) 2017/2401 (European Parliament and Council, 2017). The average (median) value of RW_{SA} is just over (under) half of the 39% for the typical CLO according to Martin and Sayrak (2022) (see section IV.3.3.2). The main reason for the deviation is that there are almost no defaulted loans in the observed CLO underlying, resulting in a W of 0 for 195 of the 199 CLO tranches.[10] The average of all other parameters is relatively close to the typical CLO. Therefore, the average RW_{SA} of the senior tranches is in the same range as the 22.8% resulting from the sensitivity analysis with a W of 0% (see Figure IV.1).

In accordance with Article 254(2)b of Regulation (EU) 2017/2401 (European Parliament and Council, 2017), RW takes the value of RW_{SA} if RW_{SA} is 25% or less, and the value of RW_{ERBA} otherwise.[11] For 17 of the 168 senior tranches, RW_{SA} exceeds 25%. In all but one of these cases, RW is 20% as M_T is at the cap of 5 years. Since RW_{SA} is above 25% in all non-senior tranches, RW uniformly takes the value of RW_{ERBA} in Panel B.

Under the narrow definition of bank tranches (only Panel A), the mean RW is 18.4%, compared to 25.5% under the broad definition (Panel A+B). Although we can't calculate RW_{IRBA} due to the unavailability of PD_U and thus K_{IRB} values, sensitivity analyses in section IV.3.4.2 indicate that RW_{IRBA} is at the 15%-floor for almost all bank tranches. The minimum attachment point A, at which RW_{IRBA} for a non-senior tranche of an otherwise typical CLO exceeds 15%, is at approximately 0.23. The lowest value of A among the non-senior bank tranches in Panel B is 0.24. Because exceeding the floor is even less common for senior tranches, the likely average RW_{IRBA} of CLO bank tranches under both the narrow and broad definition is 0.15.

[10] A possible reason for the lack of defaulted loans is the use of the first available underlying data for the calculation of W. These data show the composition of the underlying on average less than four months after the pricing date. If loans typically default some time after being purchased by a CLO, W might increase with the age of the CLO.

[11] The 75% criterion for RW_{ERBA} is not relevant in this sample, as the maximum RW_{ERBA} of a AAA-rated tranche is 70% (see Table IV.3). Alternatively, institutions are allowed to consistently use RW_{ERBA} as RW for all rated tranches (CRR, 2024, Art. 254(3)).

Table IV.6: This table presents summary statistics for RW_{ERBA} and RW_{SA} (in %), as well as their associated parameters for AAA tranches of European CLOs after the adoption of Regulation (EU) 2017/2401 (European Parliament and Council, 2017). For each parameter, the rightmost column indicates whether it is used in the ERBA or SA or in both approaches. Panel A shows summary statistics for senior tranches, Panel B for tranches that are subordinate to at least one other tranche of the CLO. RW takes the value of RW_{SA} if RW_{SA} is 25% or less, otherwise the value of RW_{ERBA}. All parameters are explained in appendix Table IV.A.1.

Panel A: Senior-Tranches

Parameter	N	Mean	SD	P10	P25	P50	P75	P90	Approaches
M_T	168	4.941	0.429	5.000	5.000	5.000	5.000	5.000	ERBA
A	168	0.402	0.068	0.365	0.380	0.396	0.418	0.451	SA
K_{SA}	168	0.112	0.003	0.109	0.110	0.113	0.114	0.116	SA
W	168	0.000	0.001	0.000	0.000	0.000	0.000	0.000	SA
RW_{ERBA}	168	19.927	0.537	20.000	20.000	20.000	20.000	20.000	
RW_{SA}	168	21.800	23.579	15.000	15.476	18.540	21.128	25.061	
RW	168	18.357	2.780	15.000	15.476	18.540	20.004	22.047	

Panel B: Non-Senior-Tranches

Parameter	N	Mean	SD	P10	P25	P50	P75	P90	Approaches
M_T	31	5.000	0.000	5.000	5.000	5.000	5.000	5.000	ERBA
T	31	0.084	0.095	0.020	0.025	0.038	0.109	0.203	ERBA, SA
A	31	0.373	0.040	0.339	0.372	0.380	0.389	0.399	SA
K_{SA}	31	0.112	0.003	0.108	0.110	0.112	0.113	0.115	SA
W	31	0.000	0.000	0.000	0.000	0.000	0.000	0.000	SA
RW_{ERBA}	31	64.086	6.676	55.814	62.350	67.374	68.265	68.633	
RW_{SA}	31	97.764	57.640	53.308	65.581	87.618	105.278	135.625	
RW	31	64.086	6.676	55.814	62.350	67.374	68.265	68.633	

Prior to the revisions, all bank tranches would have a risk weight of 20% under the standardized approach. In addition to the rating, the risk weight under the IRB approach depended on the tranche seniority. Thus, it would have been 7% for all bank tranches under the narrow definition and 7.7% ((7%*165+12%*31)/199) on average under the broad bank tranche definition (see Table IV.1). The selection of the approach was based on the approach that would have been used, if the exposure hadn't been securitized (CRR, 2013, Art. 109). Similarly, under the new regulation, the use of the SEC-IRBA requires that the underlying consists of an IRB pool (CRR, 2024, Art. 258(1)). In addition, the available information must be sufficient to determine KIRB. While it is impossible to verify the sufficiency of the available information, I assume that banks, which would have used the IRB approach before the framework revisions are now using the SEC-IRBA. In contrast, institutions that would have used the standardized approach determine RW in accordance with Table IV.6.

For institutions using the SEC-IRBA, the framework revisions are associated with an increase in the average risk weight of 8 percentage points (15%-7%) under the narrow definition and 7.3 percentage points (15%-7.7%) under the broad definition of bank tranches. For non-IRB settings, the average risk weight decreased by 1.6 percentage points (18.4%-20%) if only senior AAA tranches are considered and increased by 5.5 percentage points (25.5%-20%) if all AAA tranches are included. Thus, in three out of four constellations, the framework revisions are associated with higher risk weights and thus higher capital requirements and tranche interest rates. To estimate the effect size, these numbers are multiplied by the estimated 0.9 bp interest rate increase per additional percentage point higher risk weight derived from the average of the three empirical papers using difference-in-difference methods of loan rate changes. In the constellations with increasing risk weights, the estimates for the resulting interest rate increase range from 5 bp (broad bank tranche definition/non-IRBA) to 7.2 bp (narrow bank tranche definition/IRBA). In contrast, the negligible cost of regulatory capital found by Kisin and Manela (2016) and Plosser and Santos (2024) wouldn't result in a measurable increase in CLO interest rates.

IV.4.2 Empirical Results

CLO tranches typically have floating interest rates and are priced at a constant *Spread* over a base rate (Kundu, 2023). The base rate for nearly all European CLOs in our sample is the 3-month Euro Interbank Offered Rate (Euribor), while the spreads of US CLO tranches are almost entirely based on the 3-month London Interbank Offered Rate (LIBOR). To evaluate the hypothesis of an increase in CLO rates, the spreads before and after the framework revisions must be compared to each other. In this analysis, the beginning of the pre-revisions period is defined as January 1, 2015, resulting in a treatment and control period of similar length.

There might be several unobservable factors influencing the *Spread* of a CLO tranche that are unrelated to the framework revisions but change around the time of their adoption. The resulting endogeneity makes a simple comparison between the spreads before and after the framework revisions problematic. Therefore, US CLOs are used as a control group. In the US, the framework revisions haven't been adopted yet. Although, the Basel 3 endgame rules as proposed in July 2023 include the implementation of the framework revisions (Office of the Comptroller of the Currency et al., 2023), the final rule hasn't been issued by February 2025 (Schroeder, 2025). Thus, I include AAA tranches (senior AAA tranches for the narrow bank tranche definition) of US CLOs in the sample and run an OLS regression of *Spread* on the interaction term of the region and time dummy. Higher capital requirements due to the framework revisions should only affect the *Spread* of European CLO tranches, resulting in a positive interaction term $EUR{*}Post$.

In addition, there might by time-varying factors that only affect European but not US CLOs. Assuming that these factors cause a similar kind of endogeneity in bank and non-bank tranches, the interaction term $EUR{*}Post$ should have the same sign for both tranche types. Therefore, the regression is repeated with the sample of non-bank tranches of the same CLOs whose bank tranches are used in the first analysis. If a positive interaction term $EUR{*}Post$ in the bank tranches is caused by the framework revisions, the effect shouldn't appear in the sample of non-bank tranches.

Table IV.7 shows the number of US and European CLOs and tranches in the regression

analysis, split by pricing dates before and after the adoption of Regulation (EU) 2017/2401 (European Parliament and Council, 2017). As only CLOs with AAA-rated senior tranches are included in the analysis, senior tranches are a subsample of AAA tranches. The difference in size between the regional CLO markets is reflected in the 80% (78%) share of US CLOs (tranches).

Table IV.7: This table presents the number of CLOs in our sample, as well as the number of CLO tranches separated by the following three criteria: 1. Time before (Pre) and after (Post) the adoption of Regulation (EU) 2017/2401 (European Parliament and Council, 2017), 2. CLO region, 3. Tranches with and without banks as a relevant investor group. The broad definition of bank investor tranches (3rd row) includes all AAA tranches, while the narrow definition (last row) includes only those that are also senior tranches (i.e., not subordinate to any other tranche of the CLO).

	Pre		Post		
	EUR	US	EUR	US	Total
CLOs	103	467	168	595	1333
Tranches	624	2585	1049	3319	7577
Thereof AAA	108	548	199	846	1701
Thereof Senior	103	467	168	595	1333

Economic intuition suggests that credit risk is the most important factor in the pricing of securitizations. Several factors in the capital structure and underlying influence credit risk in a non-linear way. Therefore, RW, as calculated in Table IV.6, is used as an aggregated risk measure for the CLO tranches. In addition to the risk of a specific tranche, *Spread* should also be influenced by the market-wide level of the risk premium. The option-adjusted spreads of BAA-rated corporate bonds are used as a proxy for the market-level risk premium.[12] The *BAA Spread* is retrieved from Bloomberg and measured at the month-currency level (EUR for European CLOs, USD for US CLOs).

CLO tranches have a low secondary market liquidity, which should be compensated by an illiquidity premium. Secondary market transactions of CLO tranches are conducted through bid-wanted-in-competition (BWIC) auctions. In BWIC auctions, a group of potential buyers is invited to submit a bid for a CLO tranche. If the highest bid is below the seller's reserve price, the auction fails and the security isn't sold. Creditflux's CLO-i provides data on BWIC cover prices, which are the second highest bid (i.e., the highest unsuccessful bid) of the auction. If

[12]BAA refers to the rating scale of Moody's and is equivalent to a BBB rating on the S&P scale, which is otherwise used in this paper.

an auction has failed, the cover price column contains the information "DNT" (did not trade). Following Hendershott et al. (2024), I use the $BWIC\ Fail\ Rate$ as measurement of market illiquidity. The $BWIC\ Fail\ Rate$ is defined as the share of unsuccessful BWIC auctions among CLOs from the same region (Europe or US) in the same month as the pricing date of the tranche. The illiquidity premium of a CLO tranche should be determined not only by the liquidity at the market level, but also at the CLO level. Hendershott et al. (2024) find that BWIC fails are more likely if the issue size of the auctioned CLO is smaller. Therefore, $Log(CLO\ Size)$ is included as an additional control variable in the $Spread$ regression.

Table IV.8 presents the coefficient estimates of the OLS regression of $Spread$ on EUR, $Post$, $EUR{*}Post$ and the control variables. The odd columns show the regression results for the sample of bank tranches, the even columns for the sample of non-bank tranches. In the first two columns, the broad definition of bank tranches (i.e., all AAA-rated tranches) is used to separate bank and non-bank tranches. In columns 3 and 4, the split is based on the broad bank tranche definition (i.e., only AAA-rated senior tranches).

Overall, the coefficient estimates indicate that European CLOs have a lower $Spread$ in bank tranches and a higher $Spread$ in non-bank tranches compared to US CLOs. The $Spread$ in both bank and non-bank tranches declines after the adoption of the framework revisions in the EU, with a larger decrease in non-bank tranches. Most importantly, the small and insignificant $EUR{*}POST$ coefficients don't indicate a $Spread$ increasing effect of the framework revisions. On the contrary, the results confirm the findings of Kisin and Manela (2016) and Plosser and Santos (2024) that the costs of regulatory capital are limited.

Kisin and Manela (2016) attribute these findings to the ability of banks to avoid regulation. An alternative explanation would be a dominant role of internal capital requirements. The calculation of internal capital requirements used to manage the bank's balance sheet may be largely independent of the methods used to determine regulatory capital. In that case, regulatory changes wouldn't impact the bank's capital as long as the amount of capital required by the internal calculation still exceeds the external capital requirements.

The control variable coefficients confirm the expected determinants of the $Spread$, indicating high data quality. The only exception is the coefficient of RW for AAA-rated senior tranches

Table IV.8: This table presents coefficient estimates from the regression of the *Spread*, measured at the CLO tranche level, on dummies indicating the CLO currency and time period of issuance, as well as an interaction term between these two dummies. EUR is 1 (0) for European (US) CLOs. *Post* is 1 (0) if the pricing date of the CLO is after (before) the adoption of Regulation (EU) 2017/2401 (European Parliament and Council, 2017). The even columns show regression results for tranches without banks as a relevant investor group. The odd columns show regression results for bank investor tranches by broad (column 1) and narrow (column 3) definition. All control variables are explained in appendix Table IV.A.1. The constant is estimated but not reported and p-values are reported in parentheses.

	Broad Definition		Narrow Definition	
	Bank	Non-Bank	Bank	Non-Bank
	(1)	(2)	(3)	(4)
EUR	-23.91	28.67	-29.46	27.30
	(0.000)	(0.000)	(0.000)	(0.000)
Post	-7.17	-14.65	-10.82	-14.45
	(0.000)	(0.000)	(0.000)	(0.000)
EUR*Post	-2.70	4.66	3.84	3.11
	(0.313)	(0.442)	(0.133)	(0.596)
RW	0.58	0.51	-0.31	0.51
	(0.000)	(0.000)	(0.105)	(0.000)
Log(CLO Size)	-28.87	-79.59	-25.74	-75.50
	(0.000)	(0.000)	(0.000)	(0.000)
BAA Spread	0.33	0.84	0.31	0.81
	(0.000)	(0.000)	(0.000)	(0.000)
BWIC Fail Rate	0.50	1.36	0.45	1.34
	(0.000)	(0.000)	(0.000)	(0.000)
Manager FE	Yes	Yes	Yes	Yes
N	1701	5876	1333	6244
adj. R^2	0.675	0.805	0.707	0.816

(column 3), which is statistically insignificantly different from 0. The likely reason is that the credit risk of all tranches in this sample is so low that the small differences aren't enough to affect the *Spread*. The low credit risk of bank tranches is reflected in the fact that there have been no recorded defaults in AAA-rated CLO tranches by 2019 (Cordell et al., 2023). In line with the lower risk of bank tranches, the coefficients on the liquidity risk parameters and the market-level risk premium parameter *BAA Spread* are smaller by a factor of 2.5-3 than for non-bank tranches.

IV.5 Conclusion

This paper examines the implications of the revisions to the securitization framework implemented in the EU in December 2017. In comparison to the old regulation, the number of factors influencing the risk weight has increased significantly. Previously, the risk weight of a securitization was determined solely by the external rating, with an additional distinction between senior and non-senior tranches in the IRB approach. Since the framework revisions, even the SEC-ERBA, as the simplest of the three new approaches, includes the tranche maturity and thickness as additional parameters. Under the SEC-SA, the attachment and detachment points[13] are the two risk weight determinants related to the capital structure. The hypothetical risk weight of the non-securitized underlying calculated by the standardized approach and the fraction of the underlying loans in default complete the set of parameters defining the SEC-SA risk weight. The SEC-IRBA uses the same capital structure parameters as the SEC-SA to calculate the risk weight. Unlike the SEC-SA, the SEC-IRBA applies the IRB approach to determine the hypothetical risk weight of the non-securitized underlying, which depends on the internal estimate of the PDs of the loan pool. Moreover, the SEC-IRBA accounts for the tranche maturity and the granularity of the underlying pool, as defined by the effective number of exposures.

The framework revisions increase the risk weights and thus the capital requirements for investing banks. Under the SEC-SA, the risk weight of the senior tranche (the type of tranche in which banks primarily invest) in a typical example CLO is 38.5%, compared to 20% and

[13] In the analyses in this paper, the thickness, which is the difference between the attachment and detachment point, is considered as an independent parameter in the risk weight calculation instead of the detachment point.

7% under the previous standardized and IRB approach. Using data from a CLO-i sample, the average SEC-SA risk weight of the senior tranches is only 21.8% as there are almost no defaulted loans in the underlying pools. At 20% and 15%, the senior tranche risk weights under the SEC-ERBA and SEC-IRBA exceed those of the IRB approach but not those of the standardized approach.

Following the adoption of the revisions in the EU, the spreads declined for both bank and non-bank tranches. Most importantly, there is no statistically significant difference between the spread decrease in European and US CLOs, despite the fact that the revisions were not adopted in the US. This contradicts the hypothesis of a spread increasing effect of the higher risk weights resulting from the framework revisions. In contrast, the results confirm the findings of Kisin and Manela (2016) and Plosser and Santos (2024) that the costs of regulatory capital for banks are limited.

The impact of the framework revisions on regulatory arbitrage by banks investing in securitizations remains an open question. Under the old regulation, Efing (2020) finds that among asset-backed securities (ABS) with the same risk weight, banks with low capital ratios (i.e., capital constraint banks) tilt their investments toward the highest-yielding tranches.[14] According to the results of Basel monitoring exercises, the difference between the average risk weights of banks' securitization portfolios calculated under the old and revised frameworks decreased significantly from December 2016 to December 2018 (Basel Committee on Banking Supervision, 2017, 2019). The implication of these findings, namely an adjustment of banks' ABS investments to the framework revisions, might be an interesting topic for future research.

[14] In the sample of Efing (2020), residential mortgage-backed securities (RMBS) represent the vast majority (76%) of ABS, while CLOs and CDOs combined account for only 5% of the nominal value.

IV. References

Acharya, V. V., P. Schnabl, and G. Suarez (2013). Securitization without risk transfer. *Journal of Financial economics 107*(3), 515–536.

Association for Financial Markets in Europe (2025). Securitisation data report q4 2024 & 2024 full year. Available at https://www.afme.eu/publications/data-research/details/securitisation-data-report-q4-2024--2024-full-year. Accessed: April 20, 2025.

Basel Committee on Banking Supervision (2005). An explanatory note on the basel ii irb risk weight functions. Available at https://www.bis.org/bcbs/irbriskweight.pdf. Accessed: March 3, 2025.

Basel Committee on Banking Supervision (2006). International convergence of capital measurement and capital standards: A revised framework comprehensive version. Available at https://www.bis.org/publ/bcbs128.pdf. Accessed: March 3, 2025.

Basel Committee on Banking Supervision (2014). Revisions to the securitisation framework. First draft. Available at https://www.bis.org/bcbs/publ/d303.pdf. Accessed: November 24, 2024.

Basel Committee on Banking Supervision (2016). Revisions to the securitisation framework. Final version. Available at https://www.bis.org/bcbs/publ/d374.pdf. Accessed: November 24, 2024.

Basel Committee on Banking Supervision (2017). Basel iii monitoring report september 2017. Available at https://www.bis.org/bcbs/publ/d416.pdf. Accessed: January 17, 2025.

Basel Committee on Banking Supervision (2019). Basel iii monitoring report october 2019. Available at https://www.bis.org/bcbs/publ/d477.pdf. Accessed: January 17, 2025.

Behn, M., R. Haselmann, and V. Vig (2022). The limits of model-based regulation. *The Journal of Finance 77*(3), 1635–1684.

Benetton, M., P. Eckley, N. Garbarino, L. Kirwin, and G. Latsi (2021). Capital requirements and mortgage pricing: Evidence from basel ii. *Journal of Financial Intermediation 48*, 100883.

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

Cordell, L., Y. Huang, and M. Williams (2012). Collateral damage: Sizing and assessing the subprime cdo crisis. Available at https://www.philadelphiafed.org/-/media/frbp/assets/working-papers/2011/wp11-30.pdf. Accessed: April 20, 2025.

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

CRR (2013). Regulation (EU) No 575/2013. Original version.

CRR (2024). Regulation (EU) No 575/2013. Consolidated version as of July 9, 2024.

di Patti, E. B., M. Moscatelli, and S. Pietrosanti (2023). The impact of bank regulation on the cost of credit: Evidence from a discontinuity in capital requirements. *Journal of Financial Intermediation 55*, 101040.

Efing, M. (2020). Reaching for yield in the abs market: Evidence from german bank investments. *Review of Finance 24*(4), 929–959.

European Central Bank (2019). Financial stability review may 2019. Available at https://www.ecb.europa.eu/pub/pdf/fsr/ecb.fsr201905~266e856634.en.pdf. Accessed: December 11, 2024.

European Commission (2016a). Commission Implementing Regulation (EU) 2016/1799.

European Commission (2016b). Commission Implementing Regulation (EU) 2016/1801.

European Commission (2022). Commission Implementing Regulation (EU) 2022/2365.

European Parliament and Council (2017). Regulation (EU) 2017/2401.

Glancy, D. and R. Kurtzman (2022). How do capital requirements affect loan rates? evidence from high volatility commercial real estate. *The Review of Corporate Finance Studies 11*(1), 88–127.

Gunter, E. M. and N. W. Kraemer (2023). Default, transition, and recovery: U.s. recovery study: Loan recoveries persist below their trend. Available at https://www.spglobal.com/ratings/en/research/articles/231215-default-transition-and-recovery-u-s-recovery-study-loan-recoveries-persist-below-their-trend-12947167. Accessed: January 31, 2025.

Hendershott, T., D. Li, D. Livdan, and N. Schürhoff (2024). When failure is an option: Fragile liquidity in over-the-counter markets. *Journal of Financial Economics 157*, 103859.

Kisin, R. and A. Manela (2016). The shadow cost of bank capital requirements. *The Review of Financial Studies 29*(7), 1780–1820.

Kollmorgen, L. and J. Kramer (2024). Seeing beyond the complexity: An introduction to collateralized loan obligations. Available at https://assets.pinebridge.com/m/21d36a807f12b5fb/original/CLO-Primer-Nov-2024.pdf. Accessed: January 28, 2025.

Kundu, S. (2023). The anatomy of corporate securitizations and contract design. *Journal of Corporate Finance 81*, Article 102195.

Martin, J. and A. Sayrak (2022). Collateralized loan obligations: A primer. *Journal of Applied Corporate Finance 34*(3), 35–50.

Morningstar Inc. (2025). Morningstar leveraged loan indexes methodology. Available at https://indexes.morningstar.com/docs/rulebook/morningstar-european-leveraged-loan-FS0000HS3S. Accessed: April 3, 2025.

Office of the Comptroller of the Currency, Federal Reserve System, and Federal Deposit Insurance Corporation (2023). Regulatory capital rule: Large banking organizations and banking organizations with significant trading activity. *Federal Register 88*(179), 64028–64343.

Opp, C. C., M. M. Opp, and M. Harris (2013). Rating agencies in the face of regulation. *Journal of financial Economics 108*(1), 46–61.

Plosser, M. C. and J. A. Santos (2024). The cost of bank regulatory capital. *The Review of Financial Studies 37*(3), 685–726.

Schroeder, P. (2025). Fed's barr, stepping down from regulatory post, warns against weaker bank rules. Available at https://www.reuters.com/business/finance/feds-barr-stepping-down-regulatory-post-warns-against-weaker-bank-rules-2025-02-20/. Accessed: April 10, 2025.

S&P Global Inc. (2020). Leveraged commentary & data (lcd): Leveraged loan primer. Available at https://www.lcdcomps.com/d/pdf/LCD%20Loan%20Primer.pdf. Accessed: October 22, 2023.

S&P Global Inc. (2025). Leveraged finance european summary report: The january snapshot. Available at https://www.spglobal.com/_assets/documents/ratings/research/101615263.pdf. Accessed: March 15, 2025.

Stanton, R. and N. Wallace (2018). Cmbs subordination, ratings inflation, and regulatory-capital arbitrage. *Financial Management 47*(1), 175–201.

IV. Appendix

Table IV.A.1: In this table the variables in use are described.

Variable	Source	Level	Unit	Description
A	CLO-i	CLO tranche	Proportion	Attachment point: Threshold at which losses within the underlying pool start to be allocated to the CLO tranche.
BAA Spread	Bloomberg	Currency	Basis points	Option-adjusted spread of BAA corporate bonds over risk-free rate.
BWIC Fail Rate	CLO-i	Currency	%	Monthly share of BWIC auction fails in the secondary market for CLO tranches.
D	CLO-i	CLO tranche	Proportion	Detachment point: Threshold at which losses within the underlying pool would result in a complete loss of the CLO tranche.
EUR	CLO-i	CLO	0/1	CLO Region, 1 if Europe, 0 if US.
$K_{SA/IRB}$	CLO-i	CLO	Proportion	Capital requirements for the underlying exposure if it hadn't been securitized. Index refers to the approach used for calculation.
K_A	CLO-i	CLO	Proportion	$(1-W)*K_{SA}+W*0.5$
$K_{SSFA(K(A)/K(IRB))}$	CLO-i	CLO	Proportion	Capital requirements if K_A/K_{IRB} is less than A.
LGD	Not available	Loan, CLO tranche	Proportion	Loss given default: Expected loss if loan/tranche defaults.
Log(CLO Size)	CLO-i, FRED	CLO	Ln(USD)	Sum principle balance of all CLO-Tranches.
$M_{T/L}$	CLO-i	CLO tranche	Years	Maturity of Tranche/Loan.
N	CLO-i	CLO	Real number	Effective number of exposures calculated as follows: $\frac{(\sum_i \text{EAD}_i)^2}{\sum_i \text{EAD}_i^2}$
$PD_{(U)}$	Not available	Loan, CLO	Proportion	(Uniform) probability of default in underlying loan (pool).
Post	CLO-i	CLO	0/1	1 if Pricing date is 2017/12/12 or later, 0 if Pricing Date is earlier than 2017/12/12
$RW_{ERBA/SA/IRBA}$	CLO-i	CLO tranche	%	Risk weight applied for the calculation of equity requirements under the CRR. Index refers to the approach used for calculation.
Spread	CLO-i	CLO tranche	Basis points	Premium of the variable coupons over the risk-free rate.
T	CLO-i	CLO tranche	Proportion	Tranche thickness measured as D-A.
W	CLO-i	CLO	Proportion	Sum of underlying exposure in default divided by total sum of underlying exposure.