The Anatomy of Collateralized Loan Obligations: On the Origins of Covenants and Contract Design*

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Abstract

This paper provides a dissection of the *Collateralized Loan Obligation* (CLO) market and examine the significance of covenants in facilitating the provision of credit. Since the Great Financial Crisis, the leveraged loan market has witnessed unprecedented growth. CLOs play an increasingly central role in the provision of credit to corporations, holding as much as 75% of all new institutional leveraged loans, as reported in 2019. The rise of the leveraged loan and CLO markets have attracted the attention of central banks which have been concerned with both the growth of the market and the opaque nature of interconnections between intermediaries, leveraged borrowers, and investors. Despite their increasing importance, little is understood about CLO intermediaries. In this paper, I describe the agency frictions inherent in the CLO market, and discuss how optimal contracts are derived with covenants that curtail against such frictions. In addition, I describe the general macroeconomic milieu that has facilitated the rapid growth of the CLO market as well as recent changes that have developed. Understanding the structural aspects and dynamics of CLOs intermediaries, situated between a gamut of investors and a loan syndicate, is paramount for analysis of the innards of the market, the role of covenants, and developing insights into the shadow banking sector as well as other securitizations.

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1 Introduction

Collateralized Loan Obligations (CLOs) have gained significance as a prominent source of credit for risky firms. CLOs purchased nearly 75% of all institutional leveraged loans that were syndicated in 2019, and held 25% of all outstanding leveraged loans in 2020 (Leveraged Commentary and Data (2019); International Monetary Fund (2020)). Analogous to how asset-backed securities facilitate financing of residential real estate and automobiles, CLOs facilitate credit to the segment of constrained corporate borrowers. Despite their growing ascendancy in the risky corporate credit market, it is not well understood how these intermediaries operate in financial markets. A distinctive feature of CLOs is that their operations and activities are governed by a legal indenture, mutually agreed upon by the CLO arranger, manager, and trustee, and executed between the CLO manager and trustee, a fiduciary representative of CLO investors. This is the first of three essays (Kundu (2020*a*); Kundu (2020*b*); Kundu (2020*c*)) to explore the importance of covenants in the capital structure and design of CLOs, provision of credit to constrained firms, as well as the inherent risks to financial stability and externalities to firms.

In the aftermath of the Great Financial Crisis of 2008, extensive financial reforms were implemented to reduce vulnerabilities in the financial system and enhance overall stability. Despite the purported objectives of these reforms, the underlying leveraged loan market has experienced burgeoning development as lending standards have degraded, risk retention regulation has eased, and the ultra low-interest rate environment has facilitated demand for riskier, floating-rate investment products. As banks have shifted from an "originate-to-retain" model to "originate-to-distribute," their direct exposures to credit risk have declined. Liquidity and credit risks have been diversified to willing investors – the largest group of which are CLOs. Substitution of direct bank exposures by shadow banking institutions has diversified risk, however, it has also contributed to the complexity of interconnections and opacity of shock transmission channels (International Monetary Fund (2020)).

Study of the CLO market merits further investigation given the increase in global corporate debt and increasing prevalence of the shadow banking sector in intermediating credit. The number of outstanding CLOs increased more than twofold from 2010 (Figure 2). Recent reports claim that global corporate debt totalled between $71-75 trillion in 2018. Of this total, the US held 20% or $15 trillion, representing an increase of 41% in total US corporate debt over a ten year time horizon (Chan et al. (2020)). Leveraged loans, a subset of total corporate debt issued by riskier firms, constitute 6-25% of US GDP. CLOs, in particular, have a sizeable exposure to leveraged loans as the largest purchasers of institutional leveraged loans.

CLOs operate as *special purpose vehicles* (SPVs), typically with a manager who makes active trading decisions. An SPV issues tranched asset-backed securities or notes to investors, and uses the proceeds to finance the purchase of the underlying portfolio of leveraged loans. From a balance sheet perspective, the assets of a CLO consist of leveraged loans. The liabilities are notes which are issued to investors. Principal and interest payments received from leveraged loans are used to pay out noteholders, according to a principal and interest waterfall.

In this paper, I focus on the role of covenants in securitization and capital structure of a CLO. In principle, the financial interests of a CLO manager are most aligned with the equity class; compensation consists of a fixed fee and a subordinated fee that is proportional to the residual interest available to the equity class. This presents the canonical agency problem of corporate finance (Jensen and Meckling (1976)). It is in the interest of CLO managers to shift investment decisions in favor of the equity class to maximize revenue at the expense of debtholders. From the perspective of debtholders, a manager's effort provision is inscrutable and verifying incoming cash-flows can be costly. For this reason, legal indentures include clauses that place limits to managerial trades. In particular, managers must comply with quality and coverage covenants which are intended to be disciplining devices for managers to appropriately screen and monitor their investments. The presence of these covenants are designed to reduce the possibility of "tranche warfare." The optimal compensation contract is obtained when portfolio managers and investors optimize over a feasible set of contracts. The insights from this inquiry may be extrapolated to other securitization settings. The covenants inherent in CLO contracts are not unique to CLOs; they exist for other structured products with a similar purpose.

In addition to the feature and design of contracts, undergirding the market, I provide a comprehensive review of the CLO market including how CLOs differ from other institutions, participants, description of their lifetime, as well as the machinations and fundamental mechanics of CLOs. Moreover, I describe recent changes and developments in the markets, including emerging vulnerabilities.

The paper is organized as follows. Section 2 provides a comprehensive overview of fundamental aspects of the CLO market. Section 3 dicusses the role of covenants in CLO contracts. Section 4 describes post-crisis changes and development. Lastly, I conclude in Section 5.

2 A review of the CLO Market

In this section, I expound on the fundamental aspects of the CLO market including, an exposition of how CLOs are distinct from other funds and a survey of the participants.

2.1 What is a CLO?

A (arbitrage) CLO operates as a *special purpose vehicle* which issues tranched asset-backed securities or notes, and uses the proceeds to finance the purchase of the underlying portfolio of leveraged loans[1]. Investors gain exposure to a diversified pool of senior secured loans through the purchase of notes. The liabilities of a CLO consist of multiple debt tranches, and an equity tranche. The higher-rated (lower risk) tranches pay out lower returns relative to lower-rated (higher risk) tranches. A manager ("CLO manager") operates a CLO by making active trad-

[1]Most CLOs are arbitrage CLOs. The objective of arbitrage CLOs is to maximize the excess spread between assets and liabilities. A small share of CLOs are *balance sheet CLOs*, which are designed for banks and other financial institutions to fund loans on their balance sheet. The purpose of balance sheet CLOs is to diversify credit risk through tranching. Balance sheet CLOs sell the securitized assets to an SPV, while retaining the equity tranche.

ing decisions, and using principal and interest received from the pool of underlying leveraged loans to pay out debtholders, according to a principal and interest waterfall. Debt tranches are paid a fixed spread above the three-month LIBOR rate based on seniority, while the equity tranche receives the remaining spread between assets and liabilities, after adjusting for fees and costs. This excess spread provides a form of credit enhancement, as it may be used towards the purchase of new collateral within the parameters laid in the indenture (described further below).

Figure 1 shows the flow of funds and distribution of loans and securities in the risky corporate credit market. Banks serve as arrangers in both the syndicate loan market, and CLO market. This exposes them to pipeline risk and CLO warehousing financing risks. In the syndicated loan market, risk is shared across the syndicate which consists of banks that structure, arrange, and underwrite the deal, as well as non-bank institutional investors, including mutual funds, hedge funds, and insurance companies. Banks typically retain amortizing Term Loans A and revolving credit facilities on their balance sheet, while selling non-amortizing Term Loans B+ to other banks or non-bank institutional investors. Moreover, banks may also directly extend credit to risky corporations in the form of term loans and revolving credit facilities, without syndication. Outside of a syndicate, non-bank institutions generally cannot extend revolving credit facilities, but may provide additional funding to risky corporations through the purchase of secondary loans or securities through OTC markets, as facilitated by banks.

What constitutes the underlying asset portfolio? The underlying portfolio of assets consists largely of risky syndicated bank loans known as "leveraged loans," while the remaining portfolio may consist of other financial securities, as tabulated in Table 5. CLO portfolios typically consist of Term Loans B and lower, as revolver and Term Loans A are purchased directly by banks. The S&P Leveraged Loan index estimated the size of the global stock of leveraged loans to be $1.3 trillion in 2019 – a figure that has been cited by the Federal Reserve (Board of Governors (2019)). However, after accounting for loans that are not in the index, revolving credit facilities, and amortizing loans, the Bank of England puts the total to be closer to $3.2 trillion (Financial Policy Committee (2019)). The International Monetary Fund has assessed the total to be even larger, estimating the size of the market to be $5.0 trillion in 2020 (International Monetary Fund (2020)). While the taxonomy of leveraged loans is an inexact science as evinced by differing estimates of the size of the market, a loan is typically considered to be "leveraged" if the loan is secured by a first or second lien, and it meets one of the following criteria: *(i)* the issuing firm also issues high-yield bonds, i.e., is highly indebted, *(ii)* the issuing firm has experienced an acquisition or will finance an acquisition, *(iii)* the firm or the loan has a borrower rating below investment grade, *(iv)* the loan has a private equity sponsor, or, *(v)* the loan spread is above a prespecified threshold, typically, LIBOR+125 bps (Federal Stability Board (2019). These numerical figures put the size of the leveraged loan market between 6-25% of the US GDP. CLOs have a sizeable exposure to leveraged loans, assessed to be between $700-$870 billion (Financial Policy Committee (2019); International Monetary Fund (2020)).

Figure 2 shows the growth in the leveraged loan and CLO markets. This figure shows

the gross leveraged loan issuance (bank loans and institutional loans) in comparison to high-yield bond issuance (top left), global leveraged loans outstanding by geographic area (top right), new issue CLO volume for US and EU (bottom left), and CLOs outstanding in the US and EU (bottom right). The leveraged loan market has experienced greater growth than the high-yield bond market. This is largely driven by the growth of institutional loans. Moreover, the vast majority of both leveraged loans and CLOs outstanding are issued in North America. However, the amount of leveraged loans issued outside of North America and Europe has also been growing. Furthermore, both the US and EU experienced exponential growth in the volume of new issue CLO after 2010. The size of the market is unprecedented.

While new issuance of structured products including collateralized bond obligations (CBOs) and collateralized debt obligations (CDOs) dwindled after the financial crisis, CLOs experienced a revival. Unlike other securitizations which are static, or replaced after investor redemption, CLOs are actively managed funds which issue debt in tranches as bonds or notes with differential risk-return exposures. However, CLOs are distinguished from other funds in four ways. First, CLOs are in operation for a fixed duration – upon maturity, the fund is liquidated and investors may retrieve their investment. Second, investors have limited redemption, as the CLO can be redeemed only if equity investors vote, after the "call date." If investors need liquidity before the call date, their only option is to find a buyer to sell to. Third, CLOs are highly levered, as they take on debt to purchase their investments. This debt is committed for the duration of the CLO. Fourth, debt investors are protected from adverse contingencies. If the CLO experiences default or significant losses, cash is diverted from junior debtholders and equity holders to the senior debtholders (Creditflux (2020)).

As presented in Table 1, between 2009-2018, the median size of a CLO is $427 million, with a standard deviation of $218 million. The median Moody's Weighted Average Rating Factor is 2,853, which suggests that the pool of assets is rated in the B2-B3 range. The median annual equity distribution is 16.625%. The loans of a leveraged loan issuer are distributed across a median value of 78 CLOs. Across all CLOs, the median par value of an issuer's loans total to $105 million. The median size of a trade is $\sim$ $250 million. The median transaction is traded at par.

In Figure 3, I show the industry distribution of leveraged loans held by CLOs and leveraged loans (top), as well as the annual share of second lien loans for CLOs and leveraged loans (bottom). The top figure shows that CLO managers hold a disproportionately smaller amount of loans in the oil and gas industry, and larger amount in the telecommunications industry, relative to the industry distribution of leveraged loan issuance. This is in part, informed by historical mishaps. Historically, many CLOs held a large share of asset-heavy businesses in the industrial sector. After the oil price plunge in 2015, managers reduced exposure to the oil and gas industry by a significant margin. The bottom figure shows that CLO managers typically hold onto a smaller share of second-lien loans relative to issuance. Kundu (2020*b*) discusses this figure at greater length, and with other supporting evidence, concludes that CLO managers are not passive buy and hold investors, but actively screen their underlying portfolios.

2.2 Who participates in the CLO market?

CLOs are similar to other funds that are established as tax-exempt, bankruptcy-remote companies operating through a manager. The manager is responsible for making investment and trading decisions in accordance with covenants. According to Fitch Ratings data, the largest 30 managers represented 60% of all CLO issuance (Johnson (2018)). The most active managers of CLOs are listed in Figure 4. Many of the managers are affiliated with private equity firms or investment banks. The most active CLO managers in terms of the total amount managed are Credit Suisse, GSO Capital Partners, and Carlyle Group. CLO managers are paid a senior fee that is a fixed fee, unconditional on performance, a junior fee, proportional to the amount of money available to the subordinated class (equity), and a performance fee, for returns beyond a hurdle rate. Changes in the junior and senior fees from 2009-2018 are described in Table 4; the median junior fee remained 35 bps through 2009-2011 and declined steadily from 2011-2014 to 30 bps where it has remained. The median senior fee has ranged from 15-20 bps. The variance in fees has declined drastically in 10 years from 2009 to 2018.

There are a several other parties involved in a CLO besides the manager. Arrangers or underwriters are tasked with structuring the CLO and selling notes to investors. The top US arrangers of CLOs are listed in Figure 4. The top three arranging banks in terms of the number of deals are Citigroup, Morgan Stanley, and Bank of America Merrill Lynch. Often, the arranging bank is also responsible for providing warehouse funding for the deal and may act as the initial legal purchaser of the notes at closing or settlement date. If CLO investors experience unforeseen demand shocks, the arranging bank may end up retaining notes – a potential source of risk. Further, arrangers serve as market makers in the secondary CLO market as they have knowledge regarding the original investors of the notes, or may retain notes themselves, facilitating the match process between interested investors and potential buyers.

The contract that governs the management of a CLO is a legal indenture – a contract executed by the CLO and the trustee. The trustee acts as a fiduciary representative of the CLO investors and is typically, a commercial bank. The trustee administers collateral, maintains custody of the cash accounts, and, settles trades daily and remits funds to investors on payment dates. Additionally, the trustee is responsible for calculating whether the CLO is in compliance with covenants on a monthly basis, and circulating monthly trustee reports to investors. Furthermore, the trustee acts on behalf of investors if there is a disagreement between managers and investors. Moreover, if a CLO defaults, the trustee will seize control of the CLO at the behest of the controlling class of debtholders – typically, a share of the most senior debtholders.

In addition, there are a number of law firms, employed by the arranger, the manager, and the trustee to negotiate terms of the indenture. The majority equity arranger may also employ a law firm to negotiate contractual clauses on their behalf. There are four legal documents through a CLO's lifetime. The most significant of these contracts for the manager is the indenture, which is signed between the manager and the trustee. Additionally, there are collateral management agreements between the manager and issuers, a prospectus designed

for investors, and an interest rate hedge agreement between issuers and a swap counterparty for hedging interest rate mismatch. New contracts are typically amended from previous deals (Creditflux (2020)).

Rating agencies affect the structure of CLOs by affecting both assets and liabilities. On the liabilities side, most CLO notes, with the exception of the equity tranche are rated by one or two agencies. Agencies monitor CLO performance over the lifetime of a CLO and, correspondingly, upgrade or downgrade the rating of notes. Before a CLO comes into legal existence, arrangers solicit ratings from rating agencies for assurance of the ratings. Rating agencies have discretion to alter the structure of CLOs through different rating assignments with effects on regulatory capital (more details below). On the assets side, ratings are particularly important for CLO managers in satisfying quality and concentration limits. The distribution of S&P ratings across CLOs is shown in Figure 7. In summary, the figure shows that 29% of issued leveraged loans are rated C and below, while only 6% of leveraged loans in CLOs are rated C and below from 2009-2018. The vast majority of leveraged loans in CLOs are rated B or BB.

During the financial crisis, a seismic shift occurred in the CLO market as investors created a lasting over-the-counter secondary CLO market to offload their exposures. Most crisis buyers were hedge funds, private capital investors, and private equity firms – prospective buyers of leveraged loans as well. The creation of the secondary market changed the composition of the CLO investor base as well as the way CLOs were viewed from being exclusively long-term investments to quasi-short-term trading instruments as well. The existence of the secondary market further fueled the rise of the CLO market. However, in comparison to the total volume of outstanding CLOs, trading volumes of secondary CLOs are still meager. Many have not been traded since issuance.

CLO investors are attracted to CLOs because they offer exposure to a diversified portfolio of loans, with higher yield offerings relative to other financial products, while being perceived as more resilient, given historically low default rates. CLO investors constitute a wide spectrum of financial institutions. However, the extent to which non-bank financial institutions are involved in the CLO market remains a moot question. According to the Bank of England, 36% of CLO investors are banks, 20% are insurance companies, 10% are hedge funds, 6% are open-ended funds, 4% are CLO managers, 4% are structured credit funds, 3% are separately managed accounts, 1% are pension funds, and 15% are unallocated (international) (Financial Policy Committee (2019)). In contrast, the IMF reports that 37% of CLO investors are banks, 17% are insurers, 10% are pension funds, 9% are mutual funds, 6% are hedge funds, 5% are CLO managers, and 15% are unallocated. This is shown in graphical form in Figure 6. The large discrepancy in the amount of investment by pension funds suggests that the estimate of holdings is ambiguous for more opaque institutions. Federal Stability Board (2019) and Liu and Schmidt-Eisenlohr (2019) also provide estimates of the breakdown of investors by tranches. This is shown in Figure 8. Moreover, investment by institutions is segmented by tranches; while asset managers and insurers invest across the entire capital structure, more regulated institutions, like banks, almost exclusively purchase AAA notes. The AAA tranche is purchased mostly by banks (over 40%), followed by asset managers and insurers – the remain-

ing 15% of the tranche is held by structured credit funds, pensions, mutual funds and hedge funds. The mezzanine tranche is held mostly by asset managers and insurers – the remaining 30% is held by hedge funds, mutual funds, pensions, structured credit funds, and banks. The equity tranche is the most diverse tranche, held by structured credit funds, hedge funds, pension funds, insurers, CLO managers and private equity firms (International Monetary Fund (2020); Liu and Schmidt-Eisenlohr (2019)).

The dynamic between debtholders and equity holders is distinct from other funds as cash flows are distributed according to a waterfall in CLOs. Similar to a corporation, debtholders or lenders provide leverage to equity investors, allowing CLO managers to take on more risk and increase returns. However, to curtail against risk-shifting, managers must comply with covenants to protect the interest of debtholders. Cash flows and covenants are discussed in Section 3.

2.3 Timeline of a CLO's lifetime

The average life of a CLO spans seven years. This is shown in Figure 5. There are six main events that characterize the life of a CLO, starting from planning until call/redemption. Below, I describe the steps a CLO takes from genesis to demise.

First, a manager meets with various arranging banks to solicit information on the size of the CLO, management fees, note prices, and potential debtholders. The manager also contacts potential equity investors who may constitute the "control equity investor." This planning phase is completed roughly six months before a CLO comes into operation.

Next, the manager enters the "warehouse" phase of the portfolio, which necessitates the actual acquisition of assets. In order to fund purchases, CLOs require both equity capital and debt financing. Equity capital may come from the control equity investor, or, the CLO manager may provide the capital through another fund. However, equity capital is usually insufficient to cover the total cost of acquisition, hence, a CLO will need to obtain debt financing from a warehouse facility, typically, the arranger to complete the acquisition. The maturity of warehouse financing is generally limited to two years, as it is expected that CLO managers will pay back the debt using the proceeds of the note issues. Unlike term funding provided to CLOs, warehouse lines of credit are provided against the market value of the portfolio. If the value of investments fall below a threshold, the arranging bank may require equity holders to provide additional capital, analogous to purchasing investments on margin. If equity investors are unable to post additional capital, the CLO may be unwound in the warehouse phase, and arrangers may seize the collateral (Creditflux (2020)).

While the manager is purchasing loans for the portfolio, the arranger will market the CLO notes to investors across the country and ensure that there are buyers for the notes. Not all tranches are in equal demand, therefore, similar to bookbuilding, arrangers will syndicate CLO notes, assess total demand by tranches, and alter features of the tranches or price to secure buyers. In the month before a CLO comes into existence, the terms of the notes, including size and price are confirmed with investors. At this point, investors commit to purchasing notes.

One month later, as investors pay for the notes, a CLO will come into existence on the *closing* or *settlement* date. The time from planning to closing is typically six months.

After the closing date, the CLO manager begins receiving management fees, and must ensure that there is sufficient cash from the assets to fund the liabilities on the payment dates. Roughly four months later, a CLO becomes *effective* after it is fully "ramped up," at which point the covenants start applying and rating agencies confirm the rating of the notes. The CLO then enters the *reinvestment period* which allows the manager to conduct trades and reinvest proceeds until the end of the reinvestment period, roughly four years later. At the end of the reinvestment period, the CLO begins paying its most senior debtholders. After at least 50% of debtholders have been paid, equity investors vote to redeem the CLO if the net asset value is large enough to pay out all debtholders. Shortly thereafter, the CLO sells the loans and pays all equity holders and the CLO is redeemed – often before the maturity date. The non-call period, which lasts roughly two years after the closing date of the CLO, prohibits equity holders from calling the CLO during this period.

If a firm experiences default, a CLO is likely to receive equity shares of the defaulted firm through restructuring. In this case, CLO equity holders are unlikely to call the CLO until the defaulted assets rebound in price, to avoid losses. In this case, the CLO will continue to run until legal maturity, around 10-13 years after the closing date (Creditflux (2020)). CLOs are a cash-flow based venture. Actions through which a CLO may end up holding equity, like debt-equity swaps can reduce cash flow and put the CLO in violation of its covenants. If the CLO breaches its covenants and the CLO itself experiences default, the controlling class will decide how to proceed with the CLO. This is discussed next.

3 Covenants and Cash flows

There are several covenants CLOs have to regularly comply with. These can be classified into two classes of covenants: maintain-or-improve constraints, and constraints with tripwires for paying back liabilities prematurely. The coverage covenants act as "shock absorbers." In event of violation, coverage covenants can divert proceeds used for junior management fees and equity distributions towards paying down liabilities in event of violation, or towards the purchase of "higher-quality" collateral. Covenant violation can cause investors to lose confidence in the security and hurt the reputation of the associated manager. In addition, under more extreme circumstances, they can lead to downgrades of CLO tranches. Quality covenants are maintain-or-improve constraints, which prevent managers from making trades that can tighten the constraints. These are discussed further in detail.

As outlined in the indenture, cash flows from the underlying loan portfolio are distributed according to two waterfalls: interest waterfall and principal waterfall. The interest waterfall stipulates the conditions for distribution of interest payments to specific classes of debtholders, based on priority. Junior debtholders may only be paid after senior debtholders are paid in full, and there is sufficient cash left.

Figure 9 shows the sequence of actions a manager may take, following an interest and

principal waterfall. Consider a simplistic setting in which the manager is bound to only two sets of covenants associated with the AAA-A tranches and BBB-B tranches, respectively. Using interest proceeds from the underlying pool of assets, first, the CLO will pay tax and administration fees to the trustee who represents the investors. Then, the CLO will pay its manager a management fee. Then the CLO will pay tranche AAA-A. If the CLO passes all of its coverage covenants, it will progress down the waterfall to make interest payments on BBB-B. If the CLO satisfies all the triggers after paying tranche BBB-B, the manager will progress further down the waterfall and collect her management fee. Then, the equity tranche will receive payments up to a prespecified hurdle rate, at which point the manager will receive a performance fee and the remaining interest will be split between the manager and the equity class. The principal cascade involves fewer steps. When principal is received, the CLO manager first makes any outstanding payments to debtholders. If the CLO has been called, reached maturity, is past the reinvestment period, or has failed a coverage covenant, the manager will pay debtholders in order of seniority. Subordination creates a hierarchy for losses.

Figure 10 shows the sequence of events if the CLO *fails* its covenants. Suppose the CLO starts at the leftmost green rectangle, indicating that it has paid interest on the BBB-B tranche. If the CLO fails a interest coverage or overcollateralization covenant (described in the subsequent section), the CLO will be forced to delever. First, the CLO will pay back the principal on the AAA tranche in full. If the CLO is still failing its interest coverage or overcollateralization covenants, the CLO will have to pay back the principal on the AA tranche, and continue paying tranches in full, in order of seniority until the CLO is in compliance. Suppose the CLO has satisfied the interest coverage and overcollateralization covenants after paying the AAA tranche in full. Then, the manager will then be able to continue down the interest waterfall. If the CLO subsequently fails its interest diversion constraint, the manager will use proceeds from the underlying pool of assets to purchase new collateral until the CLO is in compliance. Then, the manager may continue progressing down the waterfall.

For illustration of how losses may distribute to different tranches, Figure 11 shows the return of the equity tranche and cumulative losses as a function of portfolio losses. The x-axis plots the distribution of portfolio losses from lowest to highest. The left y-axis plots the equity return in percent. The right y-axis plots the cumulative loss as a percent of principal balance. The equity distribution is defined as follows:

$$\text{Equity Distribution} = \frac{\text{Interest payment} \times \frac{12}{\text{Payment frequency}}}{\text{Par value of equity}} \times 100 \tag{1}$$

This figure shows that the equity return decreases monotonically in the amount of portfolio losses from lowest to highest. After returns to equity are "wiped out", subsequent tranches in ascending order of seniority are affected; tranches rated below BBB and below experience losses before the BBB tranche, A tranche, and AA tranche.

In recent years, the aggregate share of risky loans across has been less than 7%. Figure 12 shows the annual share of risky loans across all CLOs, as defined by the aggregate sum of

the share of CCC assets, defaulted assets, and discount obligations. The figure indicates that the share of assets rated CCC has been <6.5% in recent years, while the default rate has been <1% – significantly lower than the default of leveraged loans, which has hovered around 2-3%. Kundu (2020*b*) motivates the study of managerial trading behavior by further exploring this difference in default rates. Low CLO default rates have benefitted the equity tranche, which as experienced positive returns, as exhibited in Figure 13. This figure shows that the equity distribution increased from 5% in 2009, to nearly 30% in 2012. Since then, the equity distribution has declined to 10%. Equity returns exhibit high volatility, within and across years.

3.1 Why are there covenants at all?

As explained in Section 2, a CLO manager purchases a portfolio of loans which serve as collateral for senior and subordinate tranches of debt and equity. For equity investors, debt tranches provide leverage and risk premia benefits to the equity tranche. Debt is issued up until the point at which the default risk from higher leverage increases the debt credit spread by enough to decrease equity returns (Garrison (2005)). In the absence of any covenants or payout policies, upon experiencing defaults, managers are motivated to gamble for resurrection and are motivated to risk-shift given the option-like structure of the payoff to equity investors, discussed below. Following the logic of Jensen and Meckling (1976), if the marginal cost of equity monotonically declines in the leverage ratio and the marginal cost of debt monotonically increases in the leverage ratio, the optimal capital structure is determined when these marginal costs are equal. In the absence of any disciplining devices, the capital structure of CLOs creates perverse incentives for the manager. There is historical evidence of this from the CDO market – a close cousin of CLOs.

From 1998 through 2002, CDOs were inundated with a deluge of corporate defaults. According to Garrison (2005), a paper focused on managerial incentives in CDOs, the five year investment grade cohort experienced the worst financial performance during this period – 32% worse than the second worst cohort from 1982-1986, and 328% worse than average. Furthermore, in 2003, it was reported that 63% of all CDO tranches collateralized by high-yield bonds had experienced downgrades while 41% of CDO tranches collateralized by investment-grade bonds experienced downgrades. The paper provides strong evidence in support of the claim that managers exploited structural weaknesses, as the collateral held by corporate CDOs experienced greater defaults than the overall corporate debt market at every rating level, attributed to both selection ex-ante, and trading ex-post. As cited in the paper, a 2002 Moody's case study found that CDO investors could have avoided 13 out of 27 debt downgrades if the manager of a typical 1998 high-yield bond CDO held market collateral, an additional 8 downgrades could have been avoided if the manager appropriately managed risk after stress befell the market, and, "managers have introduced risk" and "deviate from the spirit of the indenture" (Garrison (2005)).

The CLO manager's financial interests are aligned with the equity tranche. A manager's compensation is based on a fixed senior fee, a junior fee proportional to the proceeds for the equity class, and, a performance fee for returns beyond a hurdle rate. Additionally, CLO man-

agers may have *skin in the game* with a personal interest in the equity tranche. As the financial interests of the CLO manager are most aligned with the equity class, compensation can be thought of as a European call option where the exercise price equals the face value of debt. If the CLO does exceptionally well, the manager will take home the bacon. But, if it does poorly, the manager will not bear any cost because of limited liability and will continue to receive the fixed senior fee while debtholders bear losses. By increasing the risk of investments, as measured by the volatility of potential outcomes, the value of the call option increases. However, greater risk can materialize as losses to debtholders if defaults are realized. Hence, there is a divergence of interests of the manager and investors of different tranches.

Debtholders are naturally averse to riskier projects as they do not benefit from greater returns; compensation for debtholders is fixed above a benchmark rate, based on seniority. For this reason, if debtholders know that it is in the interest of the highly-leveraged CLO manager to take on inordinate levels of risk to fill their coffers, they will not invest in these CLOs, ex-ante. Hence, CLOs are structured to include additional features and indenture restrictions that place limits to managerial behavior. These enhancements are analogous to dividend payout policies and debt covenants in alternate contexts (Garrison (2005)). Coverage and quality covenants inherent in most CLO indentures, as well as concentration limits, curtail risk-shifting behavior.

In DeMarzo (2005), tranching assets allows for the creation of low-risk assets which can increase the amount of capital raised by a manager. In this setting, covenants can be additionally interpreted as a safeguard in ensuring that senior debt-claims are as riskless as possible (Kundu (2020*b*)). In addition to serving as disciplining devices, contracts, more broadly, critically determine the optimal capital structure of a CLO, ex-ante, by allocating control rights between the manager and investors. The ability of managers to financially avail from a proportion of equity proceeds provides an incentive for managers to exert effort in financial management. However, this trades off with the covenants which restrict risk-shifting behavior. Hence, the introduction covenants may undermine benefits from greater effort exertion, while increasing costs to risk-shift.

In light of these tradeoffs, optimal contracts are designed as equity contracts, for they are more efficient than debt contracts, ex-ante; debtholders benefit more when the manager's incentives are aligned with the equity tranche rather than debt, due to greater benefits from higher effort provision (Garrison (2005)). Moreover, neither effort provision, risk-shifting tendencies, nor incoming cash flows are directly contractible, therefore debt financing is used as a tool to allocate control, contingent on the manager's ability to fulfill its obligations with regard to covenants (Aghion and Bolton (1992)).[2] The presence of debt-focused covenants in the contract operate as disciplining devices for managers to appropriately screen and monitor their investments, deterring risk-shifting trades. The covenants allow investors to exert control when incentives conflict and managers make poor choices. These covenants are designed to reduce the possibility of "tranche warfare" and are most efficient in addressing risk-shifting

[2]Note that covenants are not costless. They limit the choice set of investment opportunities (Smith Jr. and Warner (1979)).

without impinging upon a manager's incentives to exert effort (Garrison (2005)). Additionally, concerns about reputation can also prevent risk-shifting and force managers to exert greater effort (Hirshleifer and Thakor (1992); Diamond (1989)).

There are two broad classes of covenants: coverage covenants and quality covenants. Quality covenants are maintain-or-improve constraints, while coverage covenants can enforce punitive action. Coverage covenants, like the interest coverage and overcollateralization covenants (described below), can force managers to pay down liabilities prematurely or divert proceeds towards the purchase of value-increasing assets until the covenant is satisfied, protecting the interests of debtholders. This is analogous to the literature on dividend policies which force managers to pay excess proceeds out to debtholders, reducing the discretion for riskier management practices (Stulz (1990); DeAngelo, DeAngelo and Stulz (2006); Zwiebel (1996)). Empirical work has corroborated the theory that covenants reduce the cost of debt or agency cost of debt financing (Brady and Roberts (2015); Wei (2005); Chava, Kumar and Warga (2010); Billett, King and Mauer (2007)). Covenants add significant protection to debtholders, increasing the total amount of capital raised by CLOs, which in turn, may benefit equity investors.

A supplementary channel that can transfer wealth from debtholders to equity investors is the *dilution channel*. Equity investors benefit from diluting the claim of existing debtholders by issuing more debt, i.e., increasing leverage. If a CLO's assets experience default, a senior debtholder's claim on the CLO's assets may be diluted if firm leverage is higher. Hence, coverage covenants which stipulate a diversion of cash flow towards paying down liabilities in event of a breach, can also be thought of as *anti-dilution* covenants, as they force a reduction in the amount of leverage.

Further, reputational concerns can also serve as a mitigating force against asset substitution. CLO managers may invest in assets that are less risky and/or divest themselves of assets that are riskier to signal adeptness in marketing and advertising to potential investors. It is often cited that CLOs experienced very low defaults relative to their CDO counterparts, referring the performance of CLOs during the financial crisis. This suggests that managers may be sensitive to the default rates of their portfolios. Kundu (2020*b*) further explores this, showing that the discrepancy in default rates between CLOs and leveraged is loans is a result of active management of assets. Further, in Section 4.3.4 of Kundu (2020*b*), it is shown that the default rate of a CLO's assets is related to the subsequent initial deal size of new CLOs for a given manager. Hence, it may also be in the manager's interest to diligently manage their portfolios out of career and reputational considerations.

Lastly, the capital structure of securitized products, including CLOs, has been affected by recent banking regulation. This is discussed in detail in Section 4.2.

3.2 Coverage and Quality Covenants

The **Overcollateralization** (OC) covenants ensure that there is a specific level of subordination and coverage at all times, relative to the triggers for each tranche. The purpose of the OC covenant is to create first-loss tranches. The presence of first-loss tranches creates a cushion for principal losses that are borne by more senior tranches. In case of a covenant breach, proceeds

are diverted from junior tranches to senior tranches until the covenant is met.

$$OC = \frac{\text{Par value of collateral+Defaulted collateral value+Purchase price of discounted collateral-'CCC' excess adjustment}}{\text{Principal balance of tranche and all senior tranches}} \tag{2}$$

The equation above indicates that the covenant relies on both realized and unrealized losses of collateral. Assets in a CLO are marked to par value and are not subject to market volatility unless an asset experiences default, is downgraded to CCC, or is a discount obligation. With defaults, the asset is marked to the lower value of market value or recovery value. Excess CCC assets are marked to market value. Discounted obligations are marked to the purchase price until they trade above a threshold (typically 90) for more than 30 days. The thresholds are graded so that the Junior OC covenants fail before the Senior OC covenants. If a CLO fails an OC covenant for a particular tranche, all interest payments are diverted from tranches below that tranche to pay the principal of more senior tranches; payments are diverted in rising order of seniority, hence, the most senior tranches are most secure.[3] Specifically, if the Junior OC covenant is violated, the CLO will not be able to make distributions to the equity investors nor collect junior management fees. Unlike many debt contracts, these covenants cannot be renegotiated. Hence, violation is punitive. Kundu (2020*b*) examines how these ratios may be affected under various trading strategies. The **Interest Diversion** (ID) covenants are similar to the OC covenants insofar as the ratios are computed identically. The threshold for ID covenants is lower, therefore, the Interest Diversion covenant is triggered before any of the OC covenants. Furthermore, in case of a breach, interest proceeds are used to purchase more collateral and increase the numerator of IDT/OC covenants rather than paying down debt. Thus, managers are incentivized to purchase value-increasing assets. This covenant is effective in removing opportunities for asset substitution by forcing managers to purchase high-quality, value-increasing assets.

A CLO may violate the tranche-specific OC/ID constraint if the assets-to-liabilities threshold ratio falls below a prespecified threshold, suggesting that the adjusted par value of assets is low relative to the principal balance of that particular tranche and all tranches senior to it.

The **Interest Coverage** (IC) covenants are similar to the OC covenants, as they can also cause the CLO manager to pay down liabilities early. The IC covenants ensure that there is specific coverage for interest due on tranches relative to the IC triggers for each tranche.

$$IC = \frac{\text{Interest from collateral}}{\text{Interest due on tranche and senior tranches}} \tag{3}$$

If a IC ratio falls below a threshold, principal and interest are diverted to pay down liabilities until the constraint is in compliance with the covenant in question. A CLO may violate the tranche-specific IC constraint if the interest received from the collateral is too low relative to the interest that is owed on that particular tranche and all tranches senior to it. In event that the IC or OC covenants are triggered, the CLO manager will have to deleverage, reducing the

[3]The denominator of the OC ratio decreases, increasing the ratio.

likelihood of additional losses. Hence, the covenants make risk-shifting less profitable, and set limits to a CLO's leverage.

There are a number of maintain-or-improve covenants, known as "quality covenants." These covenants are not directly punitive, as they do not affect management fees nor equity distributions. However, the covenants stipulate that in the event that they are triggered, the manager must maintain portfolio credit quality and cannot make trades that will worsen the constraints. These covenants include the **Weighted Average Spread**, **Weighted Average Life**, **Weighted Average Rating Factor**, **Minimum Weighted Average Recovery Rate**, **CCC-bucket**, as well as **Concentration limits**. The Weighted Average spread covenant stipulates that collateral has sufficient interest proceeds to pay interest on rated notes and equity; Weighted Average Life covenant stipulates that the collateral is amortizing (limiting portfolios with high WAL exposed to downturn and default); the Weighted Average Rating Factor covenant stipulates that the average loan rating of the portfolio is above the specified threshold; the Minimum Weighted Average Recovery Rate covenant stipulates that assets meet a minimum level of recovery expectations in case of default. CCC-bucket places a limit to the amount of loans that are rated Caa1 or lower or are on watch for eminent downgrade (typically, 5-7.5%); Concentration limits are additional CLO-specific covenants that can limit exposures to various industries, second-lien loans, covenant-loans, and specific corporate borrowers.

Summary statistics on eight salient covenants are reported in Table 3. The covenants are: Weighted Average Rating Factor (WARF), Weighted Average Spread (WAS), Weighted Average Life (WA Life), Interest Diversion, Senior Overcollateralization (Classes A/B), Junior Overcollateralization (Classes $<=$ D), Senior Interest Coverage (Classes A/B), Junior Interest Coverage (Classes $<=$ D), and Interest Diversion. The median value of the WA Life and WARF constraints are below the threshold. These are maintain-or-improve covenants, thus, violation does not stringently impact managers. The median capital and liquidity constraints are above the threshold. The interquartile range of capital constraints is very narrow; $<$2% for the Interest Diversion covenant, $<$3% for the Junior OC covenant, and $<$15% for the Senior OC covenant. The liquidity constraints exhibit greater variation, and are farther from the liquidity thresholds in comparison to the capital constraints. The average risky share of a CLO is 9%. The average CCC-bucket of a CLO is 6.5%, and the average percent of defaulted loans is 2.5%.

Table 2 shows the correlation across different constraints. The Interest Diversion constraint is highly correlated with the Junior OC constraint. The Senior IC and Junior IC constraint are highly correlated. The liquidity constraints exhibit moderate correlation with the Weighted Average Spread. The capital constraints exhibit moderate correlation with the liquidity constraints. The quality constraint exhibit very low correlation between one another.

4 Changes and Developments

4.1 CLO 1.0 vs. CLO 2.0

CLOs experienced significant changes during the Great Financial Crisis. Pre-crisis deals, *CLO 1.0*, differ from post-crisis deals, *CLO 2.0* in several ways. The reinvestment period and non-

call periods of CLOs 2.0 are $\sim$ four years and $\sim$ two years, respectively, as compared with a reinvestment period of $\sim$ seven years and $\sim$ two to four years for CLOs 1.0, respectively. Additionally, with CLOs 1.0, managers are permitted to continue investment even after the reinvestment period. This is not permitted with CLOs 2.0. Moreover, CLOs 1.0 historically had high leverage as debt tranches were 10x larger than equity. The earliest CLOs 2.0 had lower leverage with debt tranches that were 4-6x larger than equity. Leverage of more recent CLO 2.0s has surpassed the leverage of CLOs 1.0. Furthermore, CLOs 2.0 allow for tranche-by-tranche refinancing and repricing, which is not permitted under CLOs 1.0; the entire CLO must be redeemed before an individual tranche is repaid (Creditflux (2020)). In summary, CLO 2.0s have shorter reinvestment and non-call periods, higher levels of subordination, and more rigorous collateral eligibility requirements as the indentures of CLO 2.0 are more restrictive than 1.0. AUM by outstanding vintage is shown in Figure 14. At the start of 2019, late vintage CLOs represented almost 50% of total CLO AUM, while CLOs issued between 2014 and 2016 represented 40% of CLO AUM.

4.2 Treatment of Securitization under Basel and Dodd-Frank

The capital structure of CLOs has changed with regulation. Under the Basel regulatory frameworks, banks are required to maintain a minimum total capital ratio of 8%. Exposure to securitized assets affects the denominator of this ratio by affecting the total value of credit risk-adjusted assets. Treatment of securitization in the denominator is two-pronged. Banks with the ability to carry out complex analyses may use the *internal ratings-based approach* and apply risk-weights based on internal modeling. Other banks can utilize the *standardised approach* and apply risk-weights using broad ratings categories. The risk-weights under the standardised approach are based on the ratings of the tranches and carry larger capital charges than the internal ratings-based approach. However, banks can circumvent paying the full capital charge. With the standardised approach, banks may employ the "look-through" approach, in which they can apply the weighted-average risk weight of the entire pool, adjusted by the concentration of the tranche in question as the capital charge. With the internal ratings-based approach, banks can apply their own model to determine the appropriate risk-weight for an unrated position.

However, the securitization frameworks of the Basel accords are not applicable in the US, as Section 939A of the Dodd-Frank Act prevents a ratings-based approach to securitizations. Instead, securitizations are treated according to a "supervisory formula approach" (SFA). The treatment of securitizations under SFA is analogous to the treatment of unrated tranches under Basel II. Because banks do not actually hold the underlying pool of the CLO, they do not have sufficient data to follow SFA. For this reason, banks often opt for the "simplifed supervisory approach" or "gross-up approach." Regardless of the approach, banks must gauge the total amount of expected credit losses of their exposures. Hence, CLO trading decisions can affect bank regulatory capital, by altering the exposure of liabilities.

Figure 15 shows how the structure of liabilities have changed from 2009 through 2018 by the number of tranches. From 2009-2012, 47% of all CLO tranches were rated AA-Aaa, as

compared to 41% between 2012-2016 and 33% from 2017-2018. The share of A-rated liabilities has steadily declined over time, while the share of Triple-C liabilities and unrated liabilities has increased. The majority of tranches that are not rated are equity and equity-like tranches. For concreteness, a quick back-of-the-envelope calculation indicates that for CLOs with standard capital structures, the share of the "A" tranche (in terms of size) decreased from 75% in 2009 to 62% in 2018. The share of the "SUB" tranche increased from 8.41% to 22.9%. Larger subordinated tranches offer better protection for senior debtholders, e.g., AAA investors, in case of a downturn. Figure 16 exhibits the variability in tranche sizes within a CLO. Most variation in tranche sizes comes from the AAA and equity tranches.

4.3 US Risk-Retention Regulation

Theories of financial intermediation suggest that securitization can affect intermediaries' due diligence. Securitization of loans allows banks to shift credit risk to securitizers. The incentives to properly monitor and screen borrowers are contingent upon the amount of risk retained by the agent who does the monitoring. In the absence of any enforcement of risk retention, informational asymmetries between end investors and earlier participants in the securitization chain can cause a "lemons" problem. The aim of risk retention is to bring the incentives of securitizers closer to traditional portfolio lending so that securitizers and originators appropriately evaluate borrowers and underwrite loans judiciously. If securitizers have "skin in the game" or retain a portion of their securitizations, they will internalize the costs and rewards of the risk they bear; informational asymmetries are reduced as compensation is sensitive to risk.

In 2014, pursuant to section 15G of the Securities Exchange Act 1934, added by section 941 of the Dodd-Frank Act, six federal agencies stipulated that the securitizer of a CLO (manager) issued after December 24, 2016 must retain 5% of the economic risk. The intent of this act was to align the interests of the securitizers with the investors, and prevent securitizers from packaging and selling risky loans to end investors who would bear the losses. However, there was wide latitude in how securitizers could satisfy this. Managers employed various risk-retention strategies like establishing capitalised majority-owned affiliate (C-MOA) companies, majority-owned affiliate (MOA) companies, or capitalised manager vehicles (CMV) to nominally meet the requirements and comply with the letter of the law. Moreover, securtizers could satisfy the retention provision by holding vertical interest (interest in equal proportions of each class of notes), horizontal interest (within a tranche), or any combination that constituted at least 5% of the economic risk of the CLO. Furthermore, securitizers could have transferred their retained interest upon approaching the "sunset" period, whereby the balance of the pool was 33% of the closing balance, notes amortized to 33% of their original principal, or two years after the closing date (Creditflux (2020)).

The risk-retention rule was reversed in February 2018. Traditional (Broadly Syndicated Loans) CLO funds no longer have to retain 5% interest in their funds. However, middle-market CLOs are still subject to the 5% risk retention rule.

4.4 Volcker Rule

The Volcker Rule, adopted in December 2013 prevents US banks and non-US banks with US branches and affiliates from sponsoring or owning interests in a wide range of covered funds, including CLOs. This is because the controlling class has the right to dismiss a manager. However, caveats apply. Banks may be exempt from the Volcker rule if they hold positions for market-making, or, hold positions to satisfy risk retention stipulations under Dodd-Frank. Moreover, "loan securitizations" are excluded, hence, banks can hold an ownership interest in a CLO if the CLO exclusively invests in loans. After the implementation of the Volcker Rule, there has been a steady decline in the share of non-loan issue types as documented in Table 5. Notably, bonds comprised 5% of a CLO's portfolio in 2011 and fell to 0.23% in 2018; letters of credit fell from 1.45% to 0% in the same time period; revolvers fell from 1.08% to 0.12% in the same time period.

4.5 Emerging Vulnerabilities

In this section, I discuss emerging vulnerabilities in the leveraged loan and CLO markets. Understanding the potential sources of stress is crucial in developing deeper insights into how shocks can propagate across the financial system, and potential amplification mechanisms. As suppliers of credit in the corporate loan market have become more dispersed in the spirit of greater risk-sharing, greater connections have formed between banks and institutions in the shadow banking sector, providing a more opaque and convoluted avenue for shocks to amplify. Additionally, the chains of intermediation have lengthened. As shown in Figure 1, direct and indirect exposures can have broader implications for the functioning of financial markets and systemic risk. Below, I enumerate general risks in the leveraged loan and CLO markets.

These mains risks have been highlighted in the recent Financial Stability Reports of International Monetary Fund (2020) and Federal Stability Board (2019).

1. **Increase in cov-lite loans:** The increase in the incidence of cov-lite loans may be driven by the availability of funding and competition for loan mandates. Additionally, as bank participation has declined in the leveraged loan market, bank incentives to monitor their borrowers has fallen while CLOs' coordination costs of monitoring have increased. Furthermore, non-bank financial institutions, like private equity firms, benefit from greater incidence of cov-lite loans, as firms can increase leverage, while "shifting risk to creditors," increasing their own returns (Federal Stability Board (2019)). Covenant breaches can force firms to the renegotiating table and force restructuring, as a covenant breach may be viewed as a *default* from the perspective of creditors. With cov-lite loans, the risk of breaching a covenant is lower. This weakens creditor protections, eliminates the option of early intervention, and can reduce recovery ex-post. As Ivashina and Vallee (2019) show, erosion of "ring-fencing" around secured assets in the presence of carve-out and deductible clauses can benefit equity shareholders.

2. **Leverage on leverage:** As a greater share of M&A and LBO deals adjust EBITDA for

synergy addbacks and operational improvements, the adjusted EBITDA figures are overstated, while the adjusted debt/EBITDA is understated. The adjustments range from 15-30% (Federal Stability Board (2019)). This suggests that firms may be more levered than they report. The risk to the shadow banking sector has increased as deals financed by non-bank financial institutions has increased more sharply than for banks (International Monetary Fund (2020)). Additionally, as ratings have declined (more single-B or lower loans) with weaker covenants (preventing early restructuring), firm leverage has increased. Within a firm, the relative amount of subordinated debt has declined, reducing the size of the loss-absorption buffer before senior loans are affected. This can have a pronounced effect on the recovery rate of senior loans. Further, the average quality of CLOs has deteriorated. As a result, credit spreads have widened with higher forecasts of downgrades and defaults (International Monetary Fund (2020)). During the financial crisis, leverage amplified shocks (International Monetary Fund (2020)). As leverage can come from a variety of sources, including the firms themselves, banks, shadow banking sector, and the credit system in aggregate, the potential for amplification is large, especially considering that leverage can be hidden. Hence, while the current schema of credit provision may be efficient, it can also introduce new risks with leverage at every juncture.

3. **Greater concentration:** Despite concentration limits, as CLOs hold up to three-quarters of all new institutional loans and one-quarter of all outstanding leveraged loans, in aggregate, they may have significant exposure to the same set of borrowers or industries. 90% of CLOs are exposed to the top 50 US borrowers, and 80% are exposed to the top five borrowers (Federal Stability Board (2019)). Default can impose negative externalities on other firms held in the CLO portfolio or the same industry. This is explored in Kundu (2020*c*). If coverage constraints become more correlated across CLOs, forced sales can cause fire sales, as shown in Kundu (2020*b*). Additionally, expected losses to subordinated tranches can be quite large. The concern of concentration is not limited to the CLO market. Banks and shadow banks have the largest exposures in the syndicated loan market, hence the potential for distress is widespread. Further, as credit suppliers operate both in the high-yield bond and loan markets, and borrowers strategically switch from the loan to high-yield bond market, price correlation between the two markets has been reported to be larger during economic downturns (International Monetary Fund (2020)). Kundu (2020*c*) provides evidence of rates equilibrating in market equilibrium.

4. **Run risk:** If there is broad demand for cash, liquidity risk can further deteriorate the amount of liquidity in CLO and loan markets. During the COVID-19 crisis, new issuance of risky credit declined sharply while bid-ask spreads soared and ETFs experienced deep price discounts (International Monetary Fund (2020)). Historically, in event of panic or shock, mutual funds experience significant outflows – COVID-19 was no exception. Given global chains of intermediation in the risky credit market, run or redemption risk anywhere can have an impact everywhere.

5 Conclusion

Collateralized Loan Obligations (CLOs) are increasingly important providers of credit to risky corporate borrowers. Despite this, little is understood on how CLOs function. This paper, along with Kundu (2020*b*) and Kundu (2020*c*), take the first step in filling the the gap on the role of CLO intermediaries in risky credit markets. With substitution between banks and shadow banking institutions in credit markets, understanding how CLOs function is critical for developing deeper insights into how the shadow banking sector operates, potential risks emanating from the sector, and, for developing policy reforms to mitigate against adverse contingencies.

In particular, this paper describes fundamental aspects of the CLO market, including the role of covenants in the design of contracts and capital structure. I discuss the interests of the two main contracting parties – the manager and investors, and, describe the nature of the contract and consequences in event of covenant breaches. Moreover, I explain how the CLO market functions and expound on salient features including recent changes, developments, and potential sources of risk. In the subsequent essays of this series, I demonstrate how the covenants can impose risks to financial stability (Kundu (2020*b*)) and have externalities to firms (Kundu (2020*c*)).

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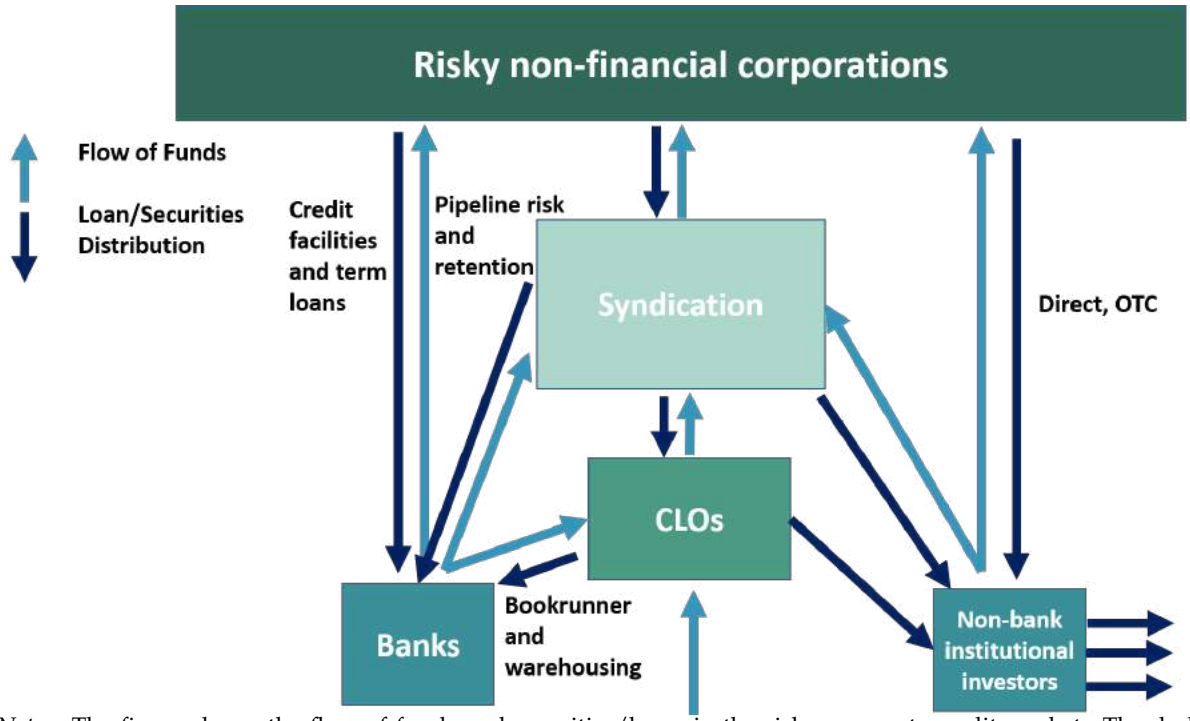
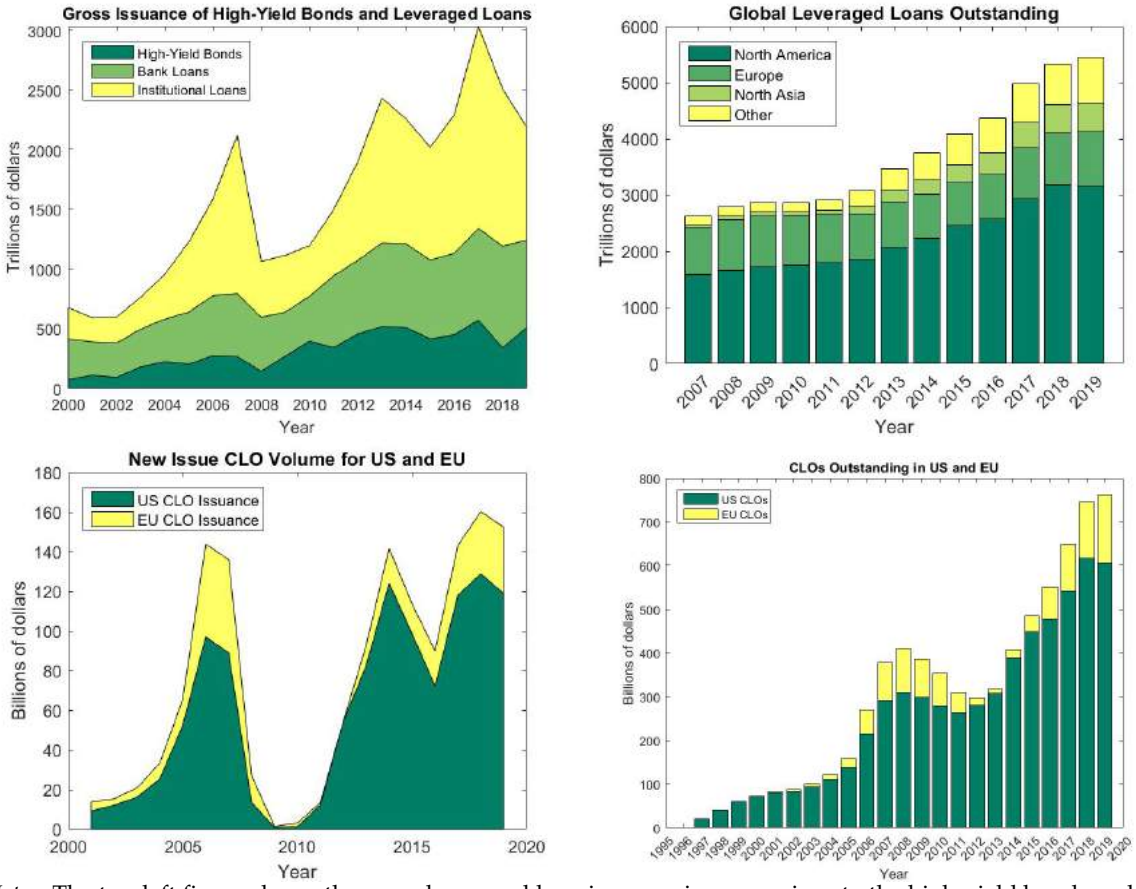
6 Figures

Figure 1: Financial plumbing of risky credit provision



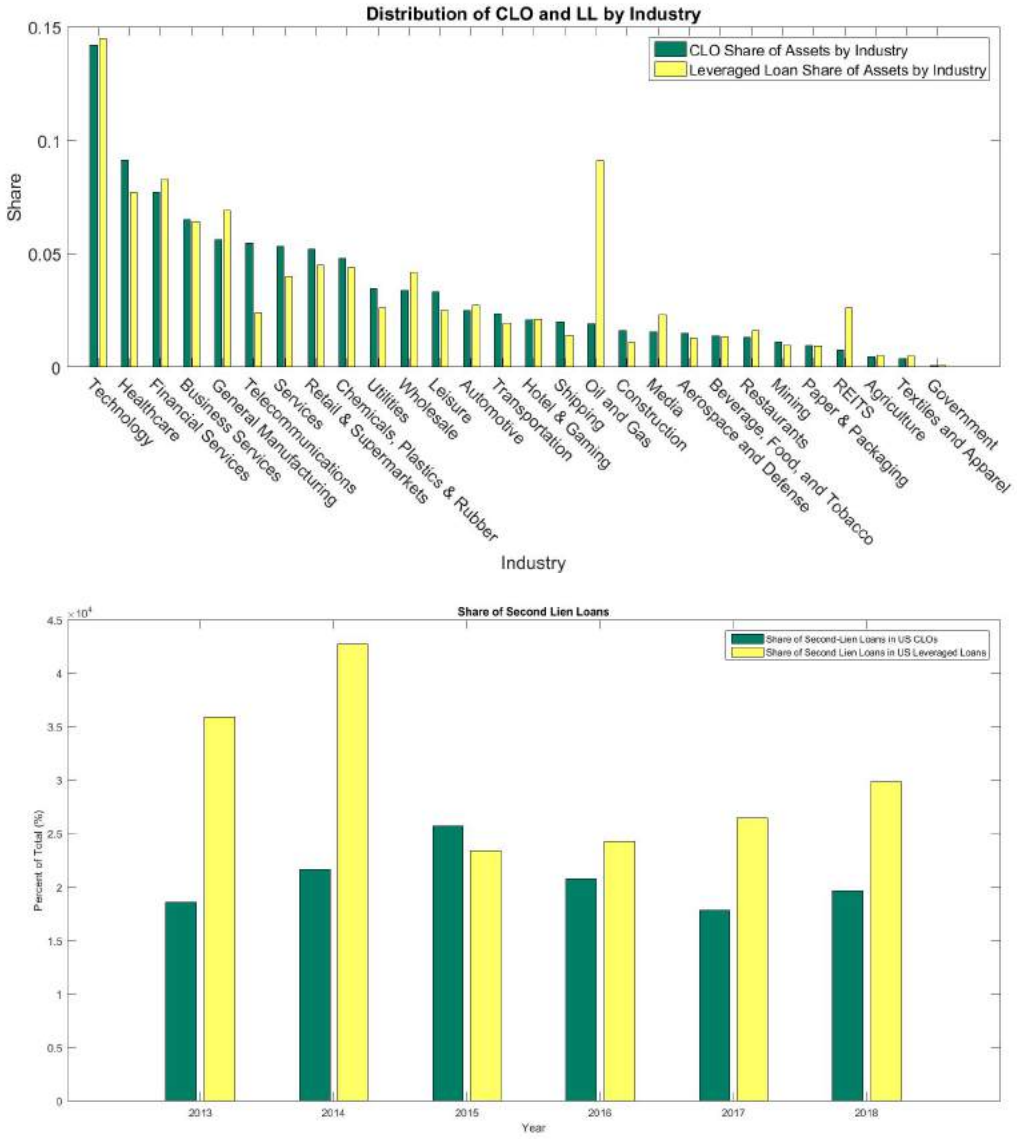
Notes: The figure shows the flow of funds and securities/loans in the risky corporate credit market. The dark blue arrows indicate the distribution of loans and securities, while the light blue arrows indicate the flow of funds. Source: Federal Stability Board (2019)

Figure 2: Leveraged Loan and CLO Outstanding and New Issuance



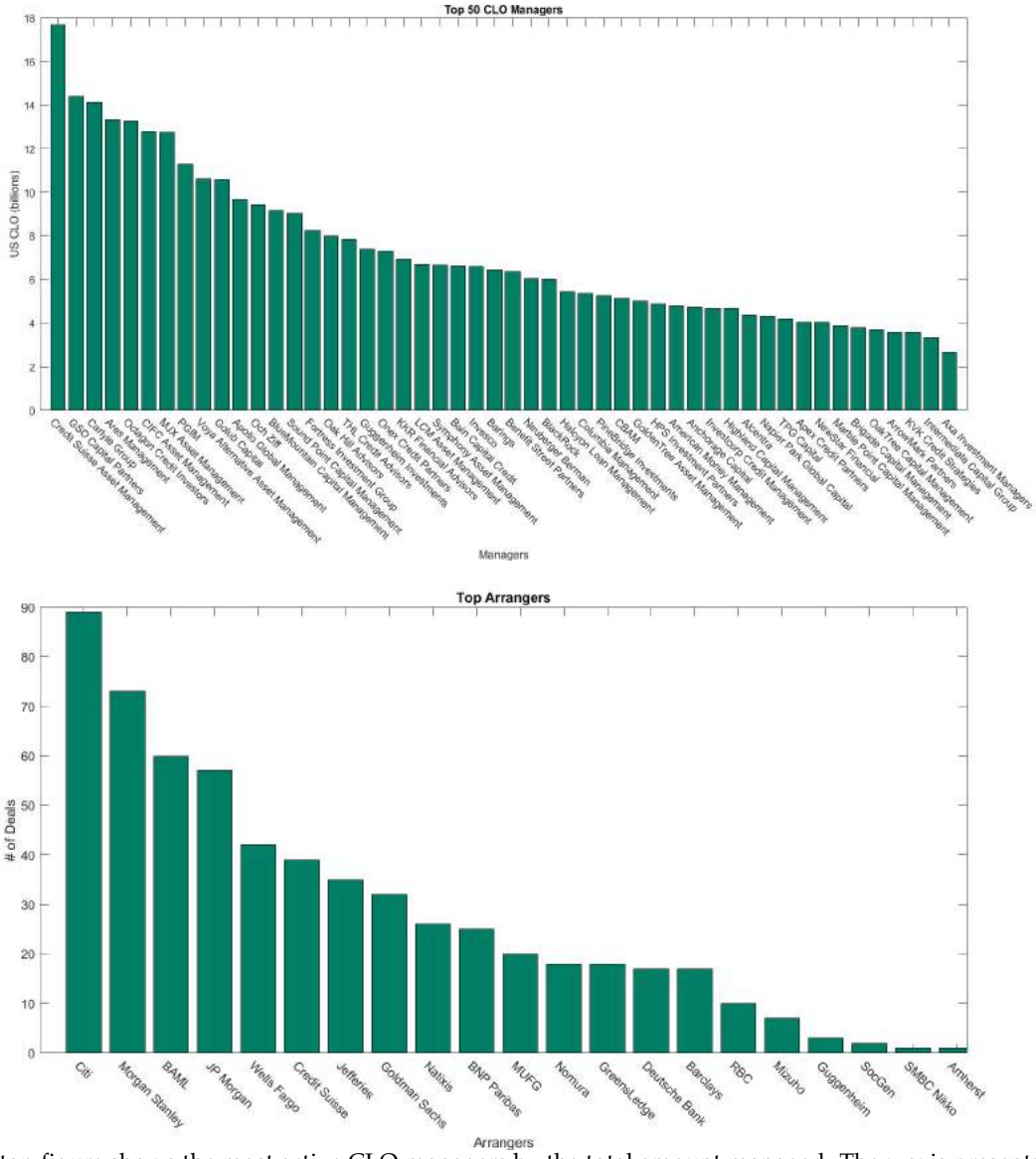
Notes: The top-left figure shows the gross leveraged loan issuance in comparison to the high-yield bond market in trillions. The top-right figure shows leveraged loans outstanding by geographic area. The bottom-left figure shows new CLO issuance in billions in the US and EU. The bottom-right figure shows the outstanding CLO volume in billions in the US and EU. The x-axis represents the year, and the y-axis represents the amount in all figures. Source: International Monetary Fund (2020)

Figure 3: Evidence of Screening: Collateral Distribution of Leveraged Loans and CLOs



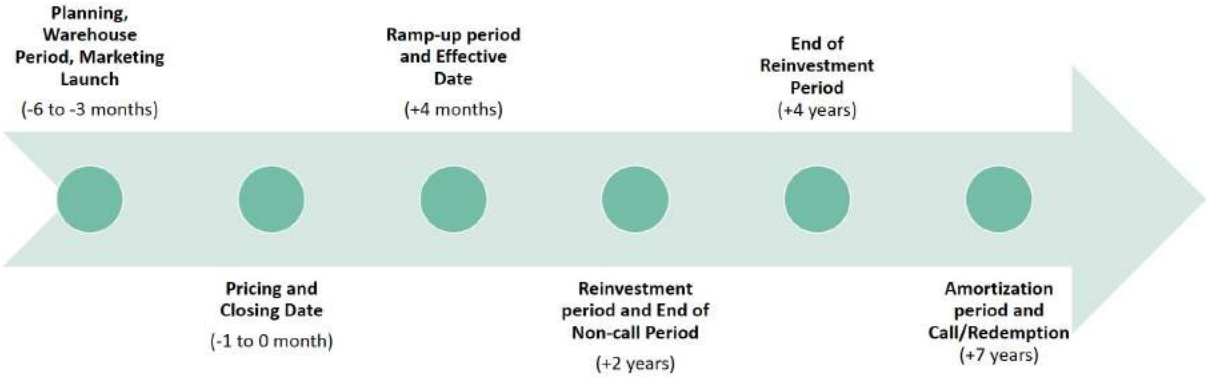
Notes: The top figure shows the industry distribution of leveraged loans at issuance, and leveraged loans in CLOs. The red bar indicates the share of leveraged loans by industry. The blue bar indicates the share of leveraged loans in CLOs by industry. The x-axis indicates the industry. The the y-axis indicates the share (out of 1). The bottom figure shows the percent of second-lien loans among new issuance of leveraged loans and CLO issuance. The red bar indicates the percent of second-lien loans in leveraged loans. The blue bar indicates the percent of second-lien loans in CLOs. The x-axis is the year. The y-axis is the percent. Source: Refinitiv LPC Loan Pricing Data

Figure 4: Most Active CLO Managers and Arrangers (2009-2018)



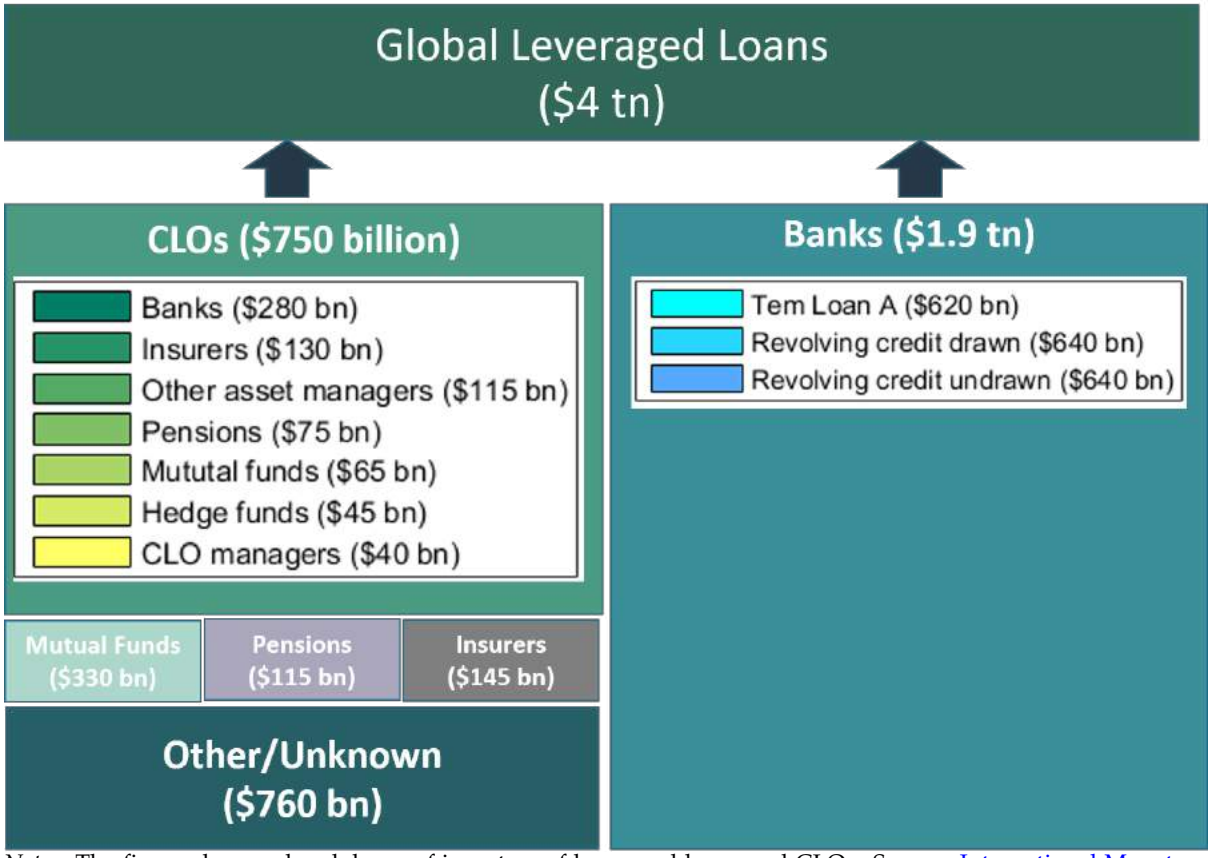
Notes: The top figure shows the most active CLO managers by the total amount managed. The x-axis presents the managers, and the y-axis represents the total amount managed in billions USD. The bottom figure shows the most active arrangers and underwriters of CLOs by number of deals. The x-axis presents the most active arrangers. The y-axis represents the number of deals. The data used to create this figure comes from Creditflux's CLO-i database and is discussed in detail in Kundu (2020*b*).

Figure 5: Lifecycle of CLOs



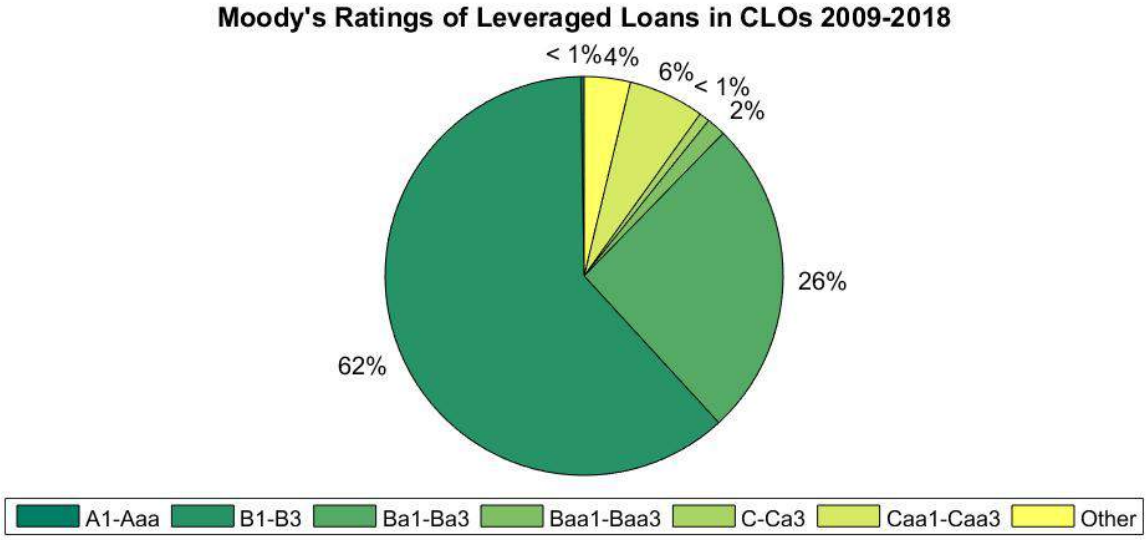
Notes: The figure shows the timeline of a CLO from planning to redemption. There are four main phases in a CLO's life: warehousing phase, effective phase, reinvestment period, and amortization. The figure above marks the six most salient events in a CLO's lifetime from planning to redemption.

Figure 6: Who holds CLOs and Leveraged Loans?



Notes: The figure shows a breakdown of investors of leveraged loans and CLOs. Source: International Monetary Fund (2020)

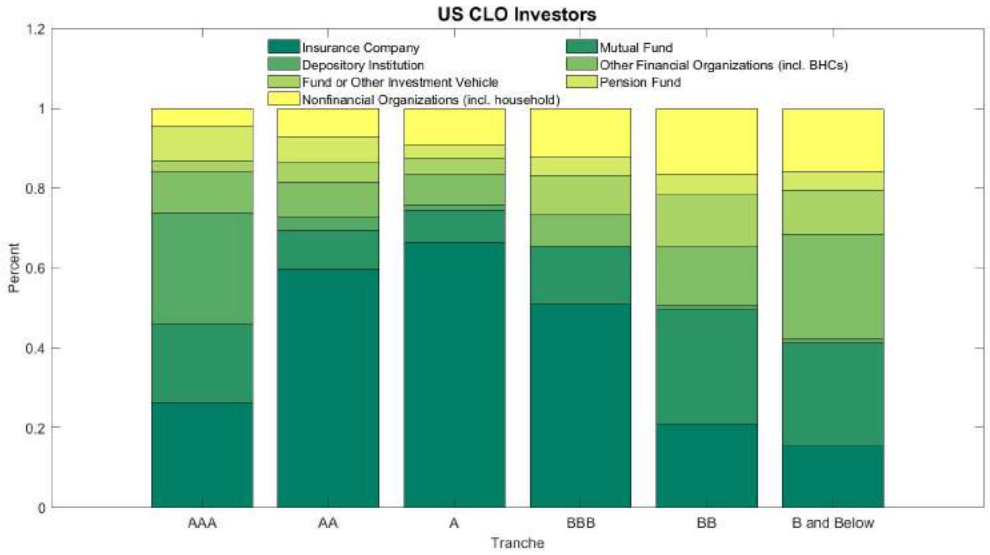
Figure 7: Ratings of Leveraged Loans and CLOs (Assets) (2009-2018)



S&P Rating	CLO Share	LL Share
A range	0.282%	-
BBB range	1.59%	1.11%
BB range	23.49%	17.17%
B range	68.99%	53.05%
C and below	5.64%	28.67%

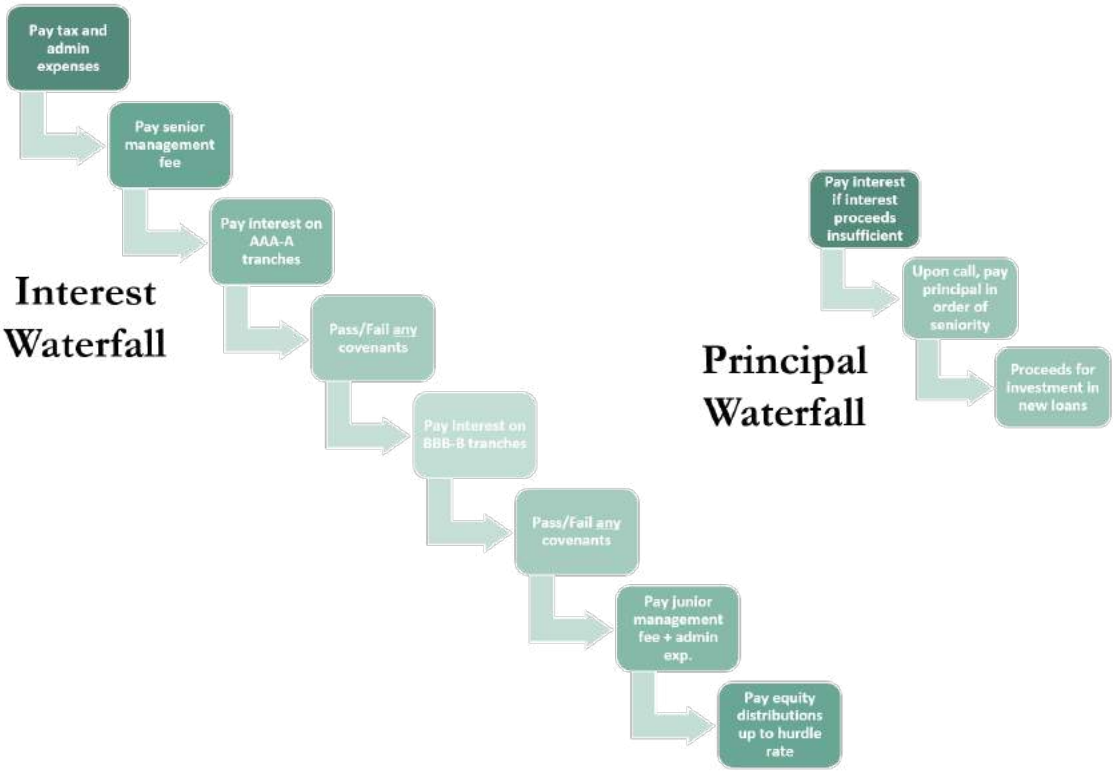
Notes: The figure shows the S&P ratings of CLO assets. The table compares the distribution of S&P ratings across CLO assets to leveraged loans. The data used to create this figure comes from Creditflux's CLO-i database and is discussed in detail in Kundu (2020*b*).

Figure 8: CLO Investors by Tranche



Notes: The figure shows a breakdown of investors of CLOs by tranche (debt). Source: International Monetary Fund (2020)

Figure 9: Cash Flows and Covenants: Sequence of Events

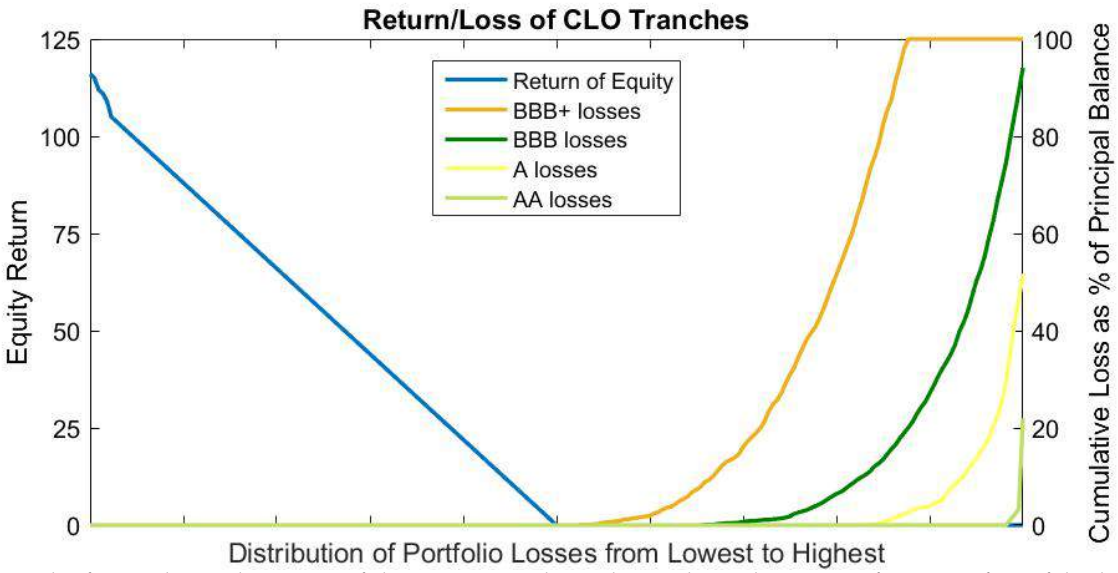


Notes: The figure shows the sequence of cash flow distributions from interest proceeds (left) and principal proceeds (right). The information to create this figure comes from Creditflux (2020).

Figure 10: Cash Flows and Events: Covenant Failures

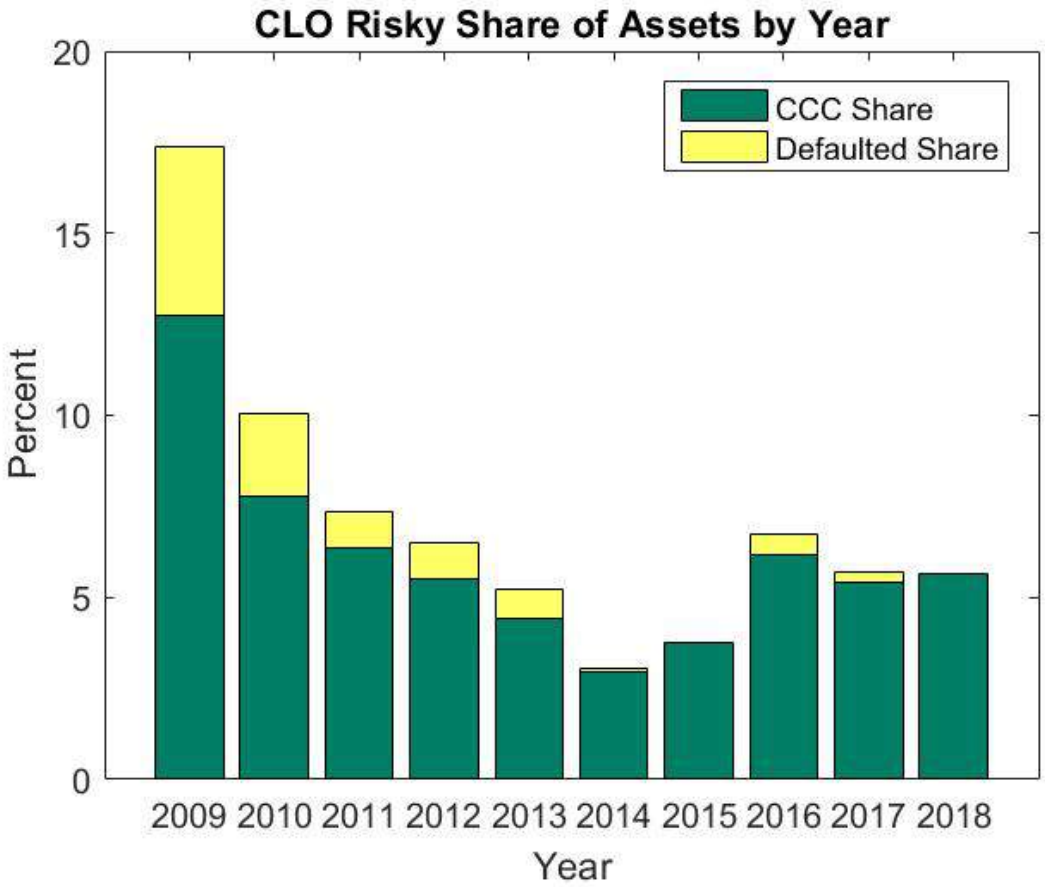
Notes: The figure shows the sequence of events prescribed to managers in event of coverage covenant breaches. The information to create this figure comes from Creditflux (2020).

Figure 11: Return/Loss of CLO Tranches



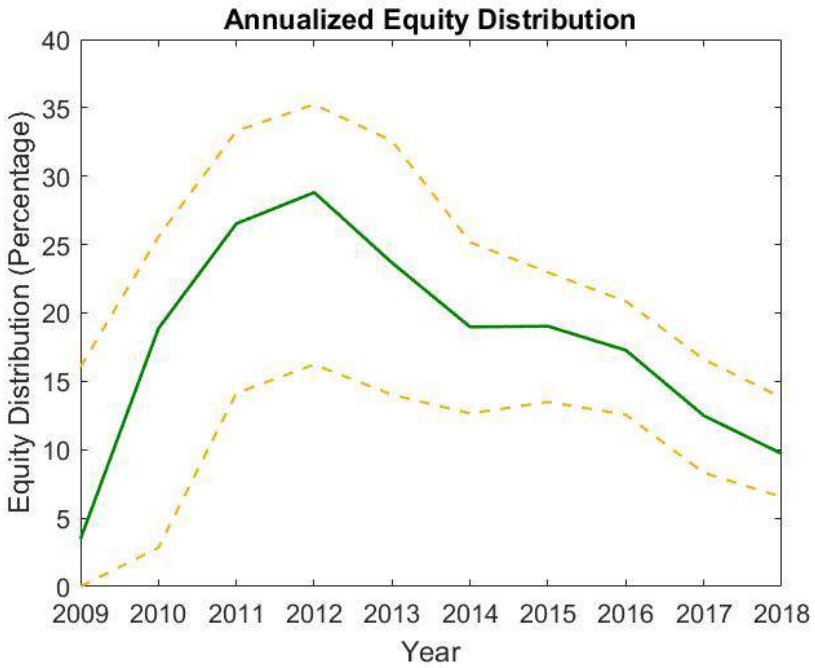
Notes: The figure shows the return of the equity tranche and cumulative losses as a function of portfolio losses. The x-axis plots the distribution of portfolio losses from lowest to highest. The left y-axis plots the equity return in percent. The right y-axis plots the cumulative loss as a percent of principal balance. The equity distribution is defined as follows: Equity Distribution $= \frac{\text{Interest payment} \times \frac{12}{\text{Payment frequency}}}{\text{Par value of equity}} \times 100$. Source: International Monetary Fund (2020)

Figure 12: CLO Risky Share of Loans (2009-2018)



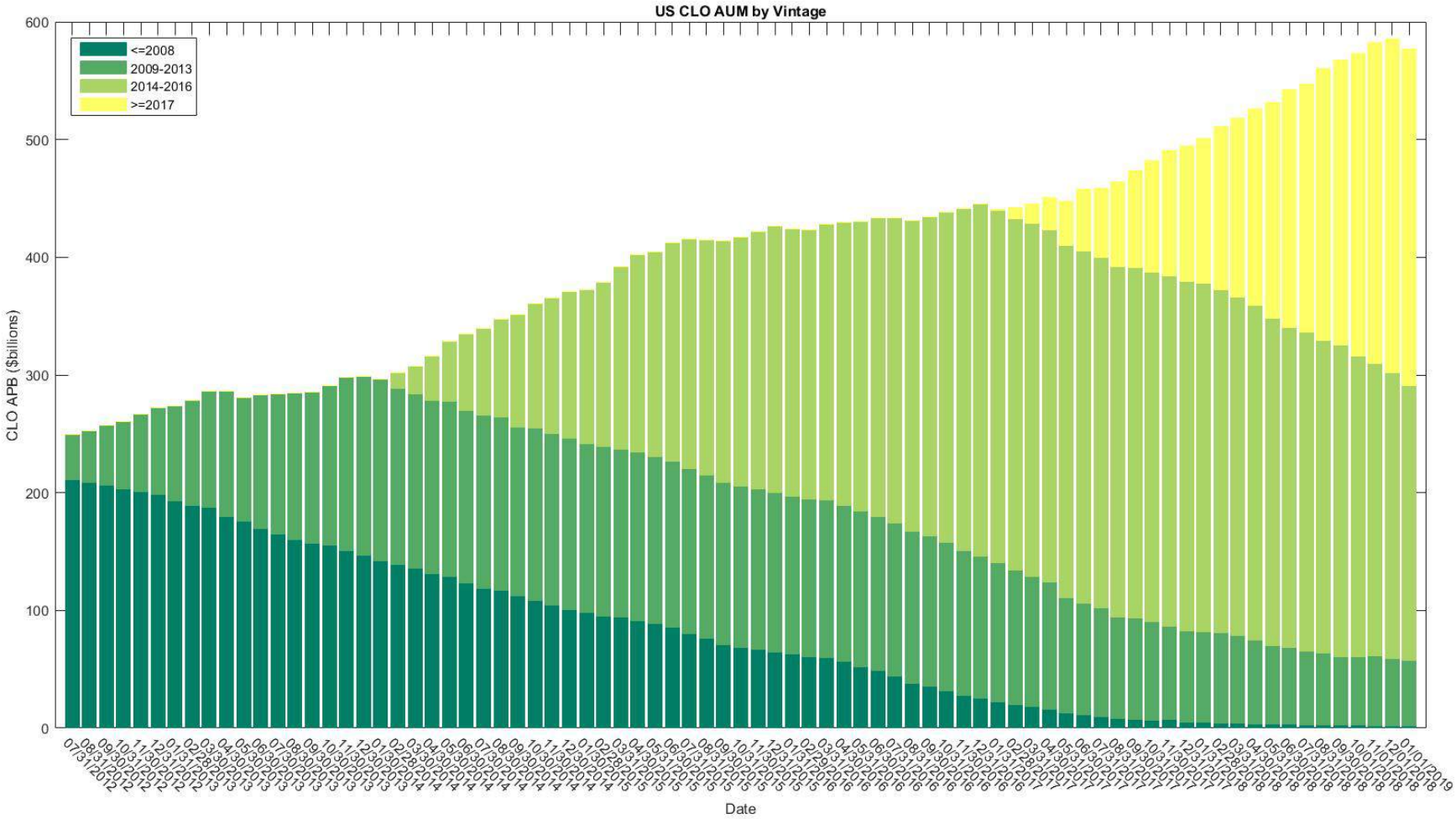
Notes: The figure shows the median CLO's share of risky loans by year. *Risky loans* are comprised of loans that constitute the CCC bucket (green) and the percent of defaulted loans and discount obligations (yellow). The data used to create this figure comes from Creditflux's CLO-i database and is discussed in detail in Kundu (2020*b*).

Figure 13: Equity Distribution (2009-2018)



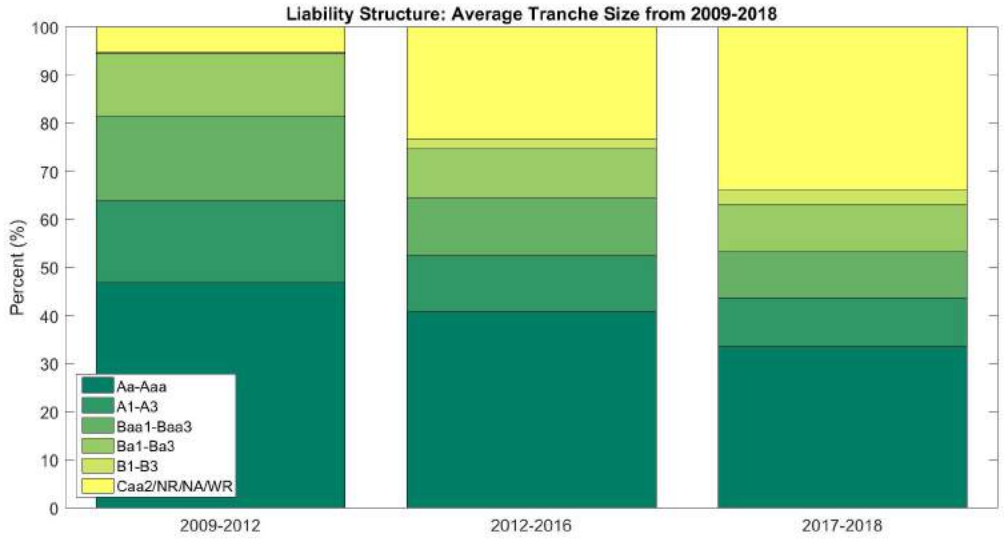
Notes: The figure shows the interquartile interval (dotted lines) of the CLOs' annual distribution to equity. The median value is plotted using a solid line. The equity distribution is defined as follows: Equity Distribution $= \frac{\text{Interest payment} \times \frac{12}{\text{Payment frequency}}}{\text{Par value of equity}} \times 100$. The data used to create this figure comes from Creditflux's CLO-i database and is discussed in detail in Kundu (2020*b*).

Figure 14: AUM by CLO Vintage (2012-2019)



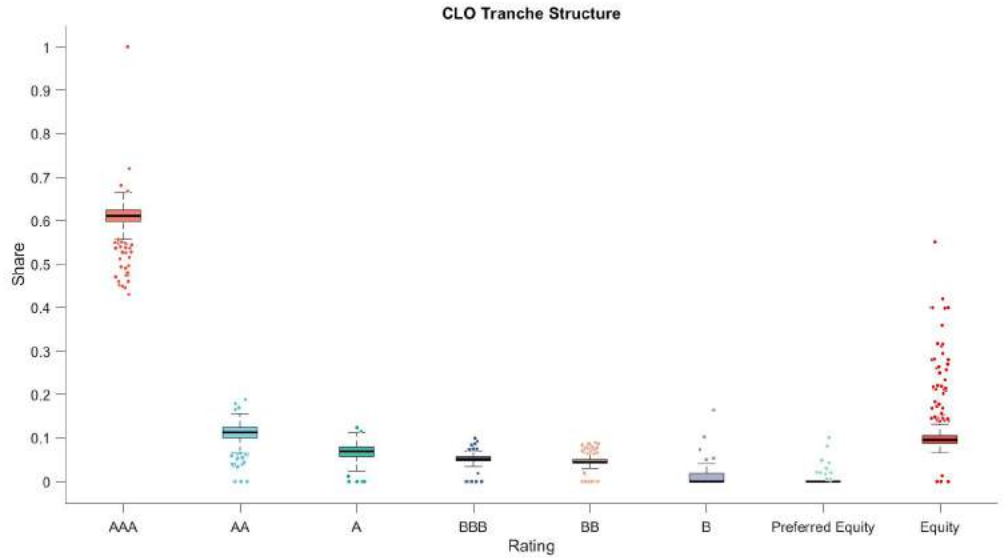
Notes: The figure shows the CLO AUM by vintage. At the start of 2019, late vintage CLOs represented 50% of all CLOs of AUM, while CLOs issued between 2014 and 2016 represented 40% of AUM. Source: Source: Refinitiv LPC Loan Pricing Data

Figure 15: Changes in Liability Structure (2009-2018)



Notes: The figure shows the distribution of tranches across all CLO liabilities by count. For example, this figure indicates that from 2009-2012, 47% of all CLO tranches were rated AA-Aaa as compared to 41% between 2012-2016 and 33% in 2017-2018. The data used to create this figure comes from Creditflux's CLO-i database and is discussed in detail in Kundu (2020*b*).

Figure 16: Distribution in CLO Liability Structure within CLOs (2011-2015)



Notes: The figure exhibits the variability in tranche sizes within a CLO by size from 2011-2015. The black bar shows the median, while the box indicates the inter-quartile range. Outliers are outside the box. Source: S&P LCD CLO Data

6.1 Tables

Table 1: Summary Statistics: CLO, Issuer, and Transactions (2009-2018)

	Panel A: CLO Level Characteristics					
	N	Q1	Median	Q3	Mean	St. Dev.
Outstanding principal (millions)	2,032	275	427	523	416	218
WARF	1,526	2,753.000	2,853.500	2,991.000	3,138.365	1,060.702
Annual Equity Distribution	1,604	12.885	16.625	20.785	17.087	6.327
	Panel B: Issuer Level Characteristics					
	N	Q1	Median	Q3	Mean	St. Dev.
No. of CLOs	2,199	2.000	78.000	199.000	124.990	150.727
Principal (millions)	2,199	6.60	105	312	229	335
	Panel C: Transaction Characteristics Characteristics					
	N	Q1	Median	Q3	Mean	St. Dev.
Transaction Sale/Purchase	978,204	-336,583	251,708	1,000,000	393,909	1,473,358
Price (% of notional par)	977,717	98.38	99.5	100	97.47	6.35

Notes: The table reports the summary statistics for the sample. The equity distribution is defined as follows: Equity Distribution $= \frac{\text{Interest payment} \times \frac{12}{\text{Payment frequency}}}{\text{Par value of equity}} \times 100$. The second column indicates the number of observations. The third column indicates the value at the 25^{th} percentile. The fourth column indicates denotes the median value. The fifth column indicates the value at the 75^{th} percentile. The sixth column indicates the mean. The seventh column indicates the standard deviation. For reference, a WARF of 1350 corresponds to a rating of Ba2. A WARF of 1766 corresponds to rating of Ba3. A WARF of 2220 corresponds to a rating of B1. A WARF of 2720 corresponds to a rating of B2. A WARF of 3490 corresponds to a rating of B3. A WARF of 4770 corresponds to a rating of Caa1. Source: Moody's Investors Service. The data used to create this table comes from Creditflux's CLO-i database and is discussed in detail in Kundu (2020*b*).

Table 2: Correlation of Covenants

	ID	JIC	JOC	SIC	SOC	WAL	WARF	WAS	CCC
Interest Diversion.	1								
Junior Interest.....	0.292	1							
Junior OC.....	0.905	0.383	1						
Senior Interest.....	0.437	0.878	0.541	1					
Senior OC.....	0.399	0.127	0.428	0.478	1				
WAL.....	−0.233	−0.209	−0.233	−0.306	−0.286	1			
WARF.....	−0.017	−0.044	−0.025	0.076	0.32	−0.09	1		
WAS.....	0.123	0.601	0.185	0.516	0.091	−0.048	−0.101	1	
CCC.....	−0.126	−0.151	−0.086	−0.057	0.182	0.056	0.328	−0.081	1

Notes: The lower triangular matrix above presents the pairwise correlation of various covenant constraints. The columns and rows denote the covenants. Each matrix element presents the correlation of the constraints corresponding to that particular column, and that particular row. The darker shading indicates higher correlation. The lighter shading indicates lower correlation. The data used to create this table comes from Creditflux's CLO-i database and is discussed in detail in Kundu (2020*b*).

Table 3: Summary Statistics of Covenants and Outcome Variables

	N	Q1	Median	Q3	Mean	Std. Dev
Interest Diversion	7,482	1.0245	1.0320	1.0378	1.0320	0.0198
Junior IC	16,742	1.7011	2.0957	3.6171	2.7282	1.4409
Junior OC	16,701	1.0343	1.0429	1.0551	1.0525	0.0400
Senior IC	18,516	2.0941	2.8731	5.8178	4.0742	2.5709
Senior OC	20,905	1.0767	1.0881	1.1519	1.2052	0.3595
WA Life	18,997	0.7108	0.8880	1.0358	1.1961	1.6459
WARF	19,545	0.8780	0.9358	0.9872	0.9471	0.1203
WAS	18,358	1.0757	1.2067	1.4033	1.2723	0.2572

Notes: The table reports the summary statistics of the constraints. The covenants are listed in the first column. The second column indicates the number of observations. The third column indicates the value at the 25^{th} percentile. The fourth column indicates denotes the median value. The fifth column indicates denotes the value at the 75^{th} percentile. The sixth column denotes the mean. The seventh column indicates the standard deviation. The data used to create this table comes from Creditflux's CLO-i database and is discussed in detail in Kundu (2020*b*).

Table 4: Fee Structure Changes (2009-2018)

Senior Fee	Junior Fee
• From 2009-2012, the 25^{th} percentile of the senior fee was 12.5 bps. The median was 15 bps, and the 75^{th} percentile was 20 bps	• From 2009-2011, the 25^{th} percentile of the junior fee was 30 bps. The median was 35 bps, and the 75^{th} percentile was 40 bps
• The 25^{th} percentile of the senior fee increased in 2012 to 15 bps from which point onward, it remained 15 bps	• The median junior fee declined steadily from 2011-2014, and remained stable from 2014-2018. The median junior fee fell to 33 bps in 2012. It fell slightly further in 2013 to 32.5 bps. Since 2014, the median junior fee has remained at 30 bps
• The 50^{th} percentile of the senior fee increased to 20 bps in 2012 and 2013. It fell back to 15 bps in 2014	• The 75^{th} percentile of the junior fee declined to 37.5 bps in 2013. Since 2014, the 75^{th} percentile of the junior fee has been 35 bps
• The 75^{th} percentile did not change. The 25^{th} percentile of the junior fee declined to 25 bps in 2016. It has remained stable since then. Overall time, the standard deviation monotonically decreased from 9.334 bps in 2009 to 3.625 bps	• Over time, the standard deviation has decreased from 11.834 bps in 2009 to 7.973 bps in 2018

Notes: The table reports the numerical changes in senior and junior fees from 2009-2008. The data used to create this table comes from Creditflux's CLO-i database and is discussed in detail in Kundu (2020*b*).

Table 5: CLO Composition (2011-2018)

Changes in Composition of CLOs (2011-2018)									
Issue Type	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**All**
Term Loan A	3.43	3.82	4.03	2.99	1.51	1.27	1.29	1.1	2.08
Term Loan B	37.83	37.55	36.45	34.74	35.4	38.66	44.18	45.72	29.03
Term Loan C	4.47	4.23	3.43	1.95	1.29	1.08	1.45	1.19	2.05
Term Loan D	0.81	0.69	0.8	0.75	0.43	0.37	0.32	0.29	0.50
Term Loan (Other)	39.55	41.36	44.52	49.59	53.84	53.45	48.71	47.32	48.82
Bond	5.01	5.22	5.05	3.31	1.42	0.73	0.32	0.23	2.06
Credit Default Swap	0.01	0.01	0	0	0	0	0	0	0
DIP	0.03	0.06	0.07	0.14	0.16	0.16	0.08	0.03	0.11
Equity	0.79	0.61	0.54	1.01	0.62	0.52	0.44	0.4	0.59
Letter of Credit	1.48	0.85	0.53	0.28	0.13	0.04	0.01	0	0.30
Mezzanine	0.26	0.09	0.03	0.01	0	0	0	0	0.04
Revolver	1.08	0.69	0.5	0.31	0.19	0.13	0.14	0.12	0.32
Second Lien	2.83	2.53	2.08	3.02	3.99	2.98	2.75	3.39	2.98
Third Lien	0.01	0	0	0	0	0	0	0.01	0
Other	2.42	2.28	1.98	1.91	1.03	0.61	0.31	0.21	1.12

Notes: The table reports the annual mean percent of each issue for each year. The last column reports the mean share across all years. The data used to create this table comes from Creditflux's CLO-i database and is discussed in detail in Kundu (2020*b*).