Consequences of CLO Portfolio Constraints*

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Abstract

We explore the extent to which CLO portfolio constraints lower CLO equity returns and affect CLO managers' loan trading choices. We document that small-sized, recently-issued CLOs with shorter maturities and greater junior noteholders' presence have more stringent portfolio constraints. CLO portfolio constraints are related to lower junior coupon premiums, suggesting that junior CLO investors likely exchange cash flow rights with control rights. Looking at the CLOs' distributions to the equity tranche, we find that constrained CLOs offer lower equity returns on a cash-flow basis, and this adverse effect is priced by CLO equity investors. Moreover, CLO managers facing more restrictive constraints rebalance their loan investments to a greater extent and more frequently. They also liquidate their profitable investments earlier and purchase riskier new investments to circumvent these binding tests. Overall, we provide evidence on the detrimental effects of CLO constraints on equity investors' returns and on managers' investment and trading strategies.

Keywords: CLOs, securitization, portfolio constraints, asset management

JEL Classification: M41, G23

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1. Introduction

Delegated portfolio management by institutional investors has rapidly increased over the last years, reaching about $55.4 trillion in size in 2016 and an annual growth rate of about 7.70% (e.g., Deloitte 2018). A distinctive structural feature in this industry is the set of portfolio investment mandates and constraints that investment managers are required to meet and restrict their portfolio allocation and reinvestment choices. Prior studies have primarily investigated the types, adoption rates and economic drivers of portfolio investment constraints (e.g., Almazan et al. 2004), as well as the role of agency costs in forming these constraints (e.g., He and Xiong 2013, Liu 2015). However, the effect of portfolio constraints on investors' returns and managers' portfolio rebalancing decisions has received little attention by prior literature.

In this paper, we explore the effect of stringent portfolio constraints in Collateralized Loan Obligations (CLOs) on the returns to CLO equity investors and on CLO managers' trading choices.[1] CLOs invest in corporate loan portfolios and are managed by large asset management firms (CLO managers). The role of a CLO manager is to monitor and regularly rebalance the loan portfolio to mitigate loan credit risks and seize new loan investment opportunities to avoid defaulting on the CLO notes and deliver high returns to the equity tranche. For a CLO to generate equity returns, the portfolio loan interest payments must substantially exceed the interest paid on CLO notes (i.e., the CLO's funding costs) and other expenses (i.e., management fees, loan transaction costs and CLO operating costs). However, CLO managers' investment latitude is limited by certain constraints set upon a CLO's origination, which impose minimum thresholds with respect to the extent to which the loan portfolio covers the outstanding amount of the CLO's

[1] Collateralized Loan Obligations (CLOs) obtain funding by issuing notes (which are bond-like securities) and an equity tranche. The equity tranche, usually purchased by hedge funds, insurance firms or the CLO manager, covers about 10% of a CLO's capital structure.

notes or the quality of the loan portfolio. A violation of these tests decreases payments to the equity tranche, as the manager needs to divert cash flows to retire the more senior notes. Thus, CLO managers are expected to rebalance the loan portfolios and generate equity returns while abiding by these constraints.

A study of the relation between CLO portfolio constraints and equity returns is relevant for several reasons. First, CLOs have fueled the substantial growth experienced by the U.S. private debt market over the last few years, raising about $1.2 trillion of capital globally over the period 2006-2017 and holding over 70% of the leveraged loan volume (JP Morgan 2018, Standard and Poor's 2015). Second, historical data suggests that CLOs' equity tranche has overall provided double-digit annualized returns on a cash-flow basis, reaching an average of 18% in 2016 (Standard and Poor's 2017). Thus, examining the interplay between the CLO's structural features and the returns generated by the equity tranche can provide an important insight into the cross-sectional variation of the returns obtained by CLO equity investors. Importantly, given that a CLO's constraints are determined upon origination, they can provide an early indicator about the future returns generated by the equity tranche. Third, CLOs report their quarterly payments to CLO investors, which allows us to construct direct, model-free estimates of the realized equity returns that are not affected by investors' perception of risk or illiquidity.

To assess the impact of CLO portfolio constraints on CLO equity returns, we collect a sample of 1,255 U.S. CLOs with detailed quarterly data on CLO portfolio performance, test thresholds and scores, and distributions to equity holders. We construct a restrictiveness index by first computing a relative restrictiveness score for each CLO test. We focus on four CLO tests: (i) the minimum capital coverage or overcollateralization (OC) test, defined as the minimum ratio of the loan portfolio value to the CLO note principal balance; (ii) the minimum interest coverage test,

defined as the minimum ratio of the interest received from the portfolio loans to the interest payable on the CLO notes; (iii) the maximum weighted average rating test (or risk test), defined as a maximum average credit risk of the portfolio loans (i.e., minimum average portfolio loan's credit rating); and (iv) the minimum weighted average spread (or income test), defined as the minimum average portfolio loan spread that needs to be maintained. The relative test restrictiveness is measured using the distribution of threshold levels for our sample CLOs. More specifically, we compute the difference between the specific test threshold and the minimum threshold of that test, scaled by the difference between the maximum and the minimum test thresholds in the CLO sample. In the case of the risk test, we compute the difference between the maximum test threshold and the specific test threshold scaled by the same denominator. As a result, each restrictiveness measure takes a value from 0 (least restrictive) to 1 (most restrictive). Finally, we compute an overall constraints index as the mean of all the test restrictiveness defined above.

We first investigate determinants of CLO test restrictiveness. We find that small-sized CLOs and CLOs with shorter maturities have more restrictive tests, potentially because restrictive test thresholds compensate for lower CLO reputation. CLOs issued after the recent credit crisis have also on average more restrictive tests. In addition, CLO test restrictiveness is positively related to the volume of junior notes issued by a CLO, potentially because restrictiveness likely serves as a protection mechanism to investors whose returns are more vulnerable to CLO portfolio losses. Looking at the junior coupon premium, we show that CLOs' test restrictiveness is negatively related to the coupon premium offered to junior noteholders relative to the one provided to the senior tranches. These findings suggest that the presence of less senior investors likely influences CLO test threshold levels.

In the second set of tests, we examine the relation between CLO test restrictiveness and the

quarterly or annualized cash distributions to CLO equity holders. We show that CLOs with stringent tests offer lower returns on a cash-flow basis to their equity tranche. Economically, an interquartile increase in CLO test restrictiveness decreases annualized (quarterly) CLO equity returns by about 6.00% (8.10%) of the mean value of the dependent variable. These results hold for almost all CLO test categories. Relatedly, we find that CLO test restrictiveness decreases CLO equity pricing, suggesting that the adverse effects of CLO portfolio constraints seem to be priced –at least, to some extent– by CLO equity investors. Economically, an interquartile increase in CLO test restrictiveness decreases CLO equity purchase price by about 2.01% of the mean value of the dependent variable.

In our third set of analyses, we attempt to identify possible mechanisms that link CLO test restrictiveness to lower CLO equity returns. Focusing on the trading choices made by CLO managers, on the one hand, CLO test restrictiveness may discipline managers' risk-taking activities. CLO managers may decrease risky loan investments and avoid frequent portfolio rebalancing to alleviate the likelihood of incurring a test violation (e.g., Helwege et al., 2016). On the other hand, CLO managers generally strive to meet the test thresholds, thus, test restrictiveness places a higher hurdle on them to achieve the necessary short-term performance to pass these tests. To do so, CLO managers may prefer to invest in loans that will offer them these short-term profits, potentially sacrificing long-term performance and the investment upside potential. For example, CLO managers may prefer to invest in riskier loans that offer higher income or hold loans until their price just appreciates to sell them immediately afterwards and cash the gains.

We document that CLO test restrictiveness is associated with greater portfolio turnover, greater loan trading volume, shorter loan average holding periods –especially for loans whose market price is increasing–, riskier loans purchases and overall lower buy-and-hold loan returns. Thus, CLO managers facing more stringent constraints rebalance their loan investments to a greater extent and

more frequently. The managers also liquidate their profitable investments sooner and purchase riskier new investments to circumvent these binding tests. Our findings are consistent with the interpretation that these CLO managers will adapt their investment and trading strategy to meet these tests, which will have a detrimental effect on CLO equity returns. Indeed, we further show that trading activities by more constrained CLOs further decrease CLO equity returns.[2]

In supplemental analyses, we find no statistically significant relation between CLO test restrictiveness and CLO credit risk as measured by the probability of a test violation or of a low test score, the likelihood of a CLO note rating downgrade or the percentage of low-quality portfolio loans, consistent with the argument that CLOs with more restrictive tests are not inherently riskier. This evidence provides further support that CLO managers engage in greater short-term loan investments and portfolio rebalancing to alleviate default costs associated with violating a test threshold. Moreover, our results are robust to alternative measures of CLO test restrictiveness.

We make several important contributions to the literature. First, we add to the emerging literature on CLOs. This literature has mainly focused on the extent to which CLOs influence loan issuance and contract design. Benmelech, Dlugosz and Ivashina (2012) have investigated whether CLOs are associated with the issuance of riskier loans but could not find any material difference between the performance of loans securitized via CLOs and non-securitized loans, suggesting that adverse selection problems are less severe in syndicated loan lending. Bozanic, Loumioti and Vasvari (2017) document that CLOs invest in loans with more standardized financial covenants while Ivashina and Becker (2016) find a strong association between the incidence of covenant-light loans and CLO's ownership of these loans, both suggesting that CLOs invest in loans with

[2] CLO managers receive an incentive management fee when they pass a certain IRR rate for the equity tranche investors (typically, about 12%). This evidence suggests CLO manager's trading behavior does not likely result from the misalignment of interests between CLO managers and equity investors, but it is rather due to CLO constraints.

simpler covenant structures to decrease their information processing costs. Another interpretation of these results, consistent with the arguments in Stein (2013), is that CLOs forego control rights in loan contracts to boost loan yields which are more visible to CLO investors. Indeed, we show that loan yields are included in CLOs' performance benchmarks (e.g., the loan income test) and CLO managers' focus on these benchmarks can negatively impact the returns to the CLO's equity holders. Consistent with our finding, Loumioti and Vasvari (2018) document that managers make attempts to manipulate CLO's performance to meet these benchmarks regularly.

Second, we bring new insights to the asset management literature. Prior research on constraints imposed by investors on managers in mutual or hedge funds shows that investment policy restrictions such as limitations on short selling, borrowing or derivative use do not result in significant return differentials (e.g., Almazan, Carlson, Brown, and Chapman, 2003) whereas investment incentives (instead of constraints) are indeed associated with better performance or higher returns (e.g., Agarwal, Daniel, and Naik, 2009). Our paper provides new evidence that adding stricter constraints on the portfolio of an asset manager results in inferior performance for CLO equity tranche investors while benefiting CLO's debt providers.

Third, we contribute to the well-established debt covenant accounting literature which has primarily examined the impact of debt covenant restrictiveness on managerial activities. Few papers within the debt covenant literature have concluded that managers make accounting choices that increase earnings and cash flows (e.g. increasing working capital accruals) when firms are close to debt covenant violations (e.g., DeFond and Jiambalvo, 1994), similar to the CLO managers' discretion in manipulating fair values or loan trading in response to restrictive CLO tests (Loumioti and Vasvari, 2017). In other words, like CLO managers, binding tests incentivize company managers to manipulate the company performance or earnings to circumvent covenant

violations, mainly via higher accruals (Sweeney, 1994; Kim, 2009). Roberts and Sufi (2009) provide additional evidence by showing that managerial actions with respect to financial decisions in response to potential covenant violations are stronger when the actions undertaken by existing creditors are more severe (i.e., when lenders increase interest rates or add distribution lock-ups). More relevant to our work, DeAngelo and Skinner (1994) find that, in their sample, covenant restrictions are responsible for almost all forced dividend reductions thereby reducing the returns for equity holders, which is a relevant association that our paper attempts to establish within the context of CLOs.

2. Institutional Background and CLO Portfolio Constraints

Since their emergence in the 1990s, CLOs have played a significant role in the financing of leveraged buyouts and acquisition finance globally. However, following the subprime credit crisis, investors lost their confidence in structured finance vehicles leading to a drying up of the liquidity and issuance of new CLOs. Not surprisingly, the emerging regulatory framework (i.e., the Dodd-Frank Act and the Volcker Rule) has changed the investing landscape for CLOs substantially following the financial crisis. An important implication of the Volcker Rule is that CLOs were prohibited from owning bonds and required to own only loans, given the lower credit volatility and higher recovery rates of senior secured loans relative to the high-yield corporate bonds. In addition, as CLOs are generally thinly capitalized vehicles, US regulators (i.e., the Federal Reserve and SEC) required that CLO managers retain some "skin in the game" in order to ensure a better alignment of interests with their investors. More specifically, the Dodd-Frank Act (Section 941), enacted in 2010, required CLOs to retain 5% of the credit risk based on the value of the CLO's

liabilities (e.g., Coffey, 2015).[3]

While regulatory interventions aim to increase the alignment of interests between CLO managers and investors in CLO notes, CLO prospectuses negotiated by managers with investors in various CLO tranches provide additional features that increase alignment and provide credit protection. First, most CLOs provide managers an incentive fee which is paid only when investors in the equity tranche achieve a minimum threshold internal rate of return (or "hurdle rate"), most commonly set at 12%.[4] This fee is in addition to the senior and subordinated management fees which combined are usually set at 50 bps of the total balances of the CLO per annum and are paid before the equity tranche is paid.[5] The performance fee aligns managers with investors in the equity tranche and provides managers with strong economic incentives to manage the loan portfolio to achieve positive outcomes. Second, CLOs improve credit enhancement levels by requiring a set of compliance tests that have to be met and reported each month. These tests provide an essential mechanism to detect and potentially correct a deterioration in the CLO's portfolio quality. Previous empirical research has demonstrated that securitization and the potential lack of such tests in the context of subprime mortgages lead to lower lending standards which could – in turn – resulted in lower quality portfolio collateral (i.e., Keys, Mukherjee, Seru, and Vig, 2010; Nadauld and Sherlund 2009).

The most prominent of CLO compliance tests are the *overcollateralization (OC) tests.* The OC tests require that the ratio of the CLO's loan portfolio value, scaled by the CLO notes' principal

[3] This retention rule was subsequently challenged by the Loan Syndications and Trading Association (LTSA) given its arbitrary nature and repercussions on the growth of the CLO industry. The US Court of Appeals for the District of Columbia ruled in favor of LTSA in February 2018, allowing CLO managers not to comply with the US risk retention rules. Compliance with EU risk retention rules is still obligatory for European CLOs.

[4] The incentive fee is typically set as an annual percentage of 0.125% of the CLO's portfolio balance or 20% of the remaining funds, if any left, after the hurdle IRR to the equity holders is satisfied (e.g. Yan, 2012).

[5] The senior fees are paid after all the admin fees are paid but before any CLO debt tranches are paid in interest, while the subordinate fees are paid after all the debt tranches are paid in interest but before the equity tranche is paid. The usual split between senior and subordinate fees is 15 bps/35 bps or 20 bps/30 bps.

balance, exceed a certain threshold. A typical CLO issues both junior notes which are first to be affected by a decrease in the portfolio value and senior notes which incur losses only after the junior notes are wiped out. A CLO's portfolio value is measured as the sum of five components: (1) The principal balance of all performing loans in the portfolio. These loans usually represent the majority of a CLO's assets (i.e., more than 90% of portfolio loans). (2) The cash generated from trading activities and loan payments that is expected to be reinvested in new loans or disbursed to noteholders. (3) The aggregate expected recovery of loans in default. Defaulted loans are those that do not pay principal and/or interest, are D-rated or whose borrower filed for bankruptcy. The recovery values for these loans are computed as the lower of their fair values or the recovery values provided by credit rating agencies such as S&P and Moody's. (4) The aggregate fair value of CCC-rated loans above the maximum CCC-rated loan balance that a CLO is allowed to hold in the portfolio.[6] (5) The aggregate purchase price of portfolio loans purchased at 80% - 85% of par value or below. These definitions are standardized across CLOs and explicitly described on CLO prospectuses.

A second test is the *interest coverage (IC) test* which ensures that the loan collateral pool generates adequate interest cash flows to service the interest on each type of CLO note. This test is the ratio of interest income received on the portfolio loans to interest payments due on a particular set of CLO notes at each payment date. The minimum subordinated note coverage ratios are generally set lower than the minimum mezzanine note coverage ratios, which are, in turn, set lower than the minimum senior coverage ratios. For this reason, subordinated notes coverage tests

[6] For traded loans, loan fair values are based on their market prices retrieved from Intex, Loan Pricing Corporation or Markit. For non-traded loans, CLO managers seek loan bids from usually three independent broker-dealers to determine the loans' fair values. If such bids cannot be obtained, CLO managers set the loan fair values themselves.

are breached earlier than mezzanine note coverage tests. The lower the minimum ratio required for any coverage test, the lower the amount of losses that will breach that test.

The *loan risk test* (also called the weighted average rating factor or WARF) is another test. To calculate the weighted average rating factor on a CLO, rating agencies must first determine a credit rating for each loan in the CLO's portfolio. This rating can range from extremely high credit quality (AAA) to low quality (CCC) to default (D). The letter rating corresponds to a numerical rating factor, which in turn corresponds to the 10-year probability of default of a loan. To compute WARF, the notional balance of each loan is multiplied by the rating factor and then these values are summed. This sum is then divided by the total notional balance of the portfolio.

Finally, CLOs need to pass a *loan income test* which the average effective interest rate spread for the loan portfolio over an index rate such as LIBOR. This test ensures a minimum level of income from the underlying portfolio that should be sufficient to pay interest on the notes issued by the CLO. [7]

CLO trustees, typically banks, are mandated with the monthly monitoring of the CLO tests and to keep CLO note investors informed. Their main task consists of preparing monthly reports provide information on CLO test compliance, collateral concentration limits, trading activity, and changes in loans' credit ratings. Many investors rely exclusively on trustee reports to monitor the CLO's collateral quality which, in turn, emphasizes the importance of the CLO manager's diligence and oversight of trustee reporting.

Violation of the CLO tests has significant implications for CLO managers. If test violations are not resolved within the allowed cure period, which depends on the CLO test type, then managers

[7] Additional tests determine the portfolio's concentration on certain loans. For instance, these limitations relate to the portfolio's allocation to low-rated loans (e.g., a maximum percentage of CCC-rated loans), covenant-lite loans or loans issued from the same borrower or in the same borrower's industry (i.e., borrower and industry diversification). We attempt to control for CLO's performance on these tests across our multivariate tests.

face the following adverse consequences: (i) interest and principal cash flows are diverted from more junior tranches to pay down the CLO's liabilities in order of their seniority until the specific test is again in compliance, (ii) interest payments to more junior tranches are suspended and are used to purchase additional collateral, (iii) principal and interest payments cannot be reinvested to buy new leveraged loans, (iv) CLO notes are potentially downgraded by credit rating agencies, and (v) managers cannot receive performance-linked compensation (i.e., circa 40 basis points of a CLO portfolio's par value). Even though CLO test violations have significant repercussions, the worst-case scenario would occur when the CLO's performance triggers an Event of Default which typically happens when the OC test falls below a second threshold. In this scenario, the reinvestment period (typically five years) is terminated and all cash flows are used to repay all CLO notes in order of seniority. Finally, when the CLO tests are not met, the CLO manager needs to actively trade loans within the portfolio in order to bring this test to compliance.

3. Data Methodology

3.1. Data

We obtain loan-level data on CLOs' portfolio structure, performance, and trades from the Creditflux CLO-i database, which retrieves information from CLOs' monthly reports starting from January 2008. The CLO portfolio data includes loan-level information on loan type, maturity, face amount held, Moody's and S&P credit ratings, as well as the borrower's name and industry. The CLO monthly performance data includes the percentage of CCC-rated and defaulted loans, as well as the slack and thresholds on the overcollateralization, interest coverage, WARF and weighted average spread tests.[8] Moreover, CLO-i retrieves data on distributions to equity investors from

[8] CLO-i also covers data on the weighted average life (WAL) test that examines whether the average maturity of the underlying loan portfolio matches the maturity of CLO notes. We exclude this CLO test from our analyses, since its threshold varies per month, and CLO managers may not rebalance their portfolios on a monthly basis strictly to pass

CLO payment reports on a quarterly basis. To match the different reporting frequency of CLO portfolio and performance data and CLO payments, we average portfolio and performance characteristics at the CLO-quarter level. Our sample covers complete data on the performance, portfolio structure and distributions of 1,255 U.S. CLOs (15,711 observations at the CLO-quarter level) over the 2008-2017 period. These CLOs are originated over the period 2000-2017.

We examine CLOs' trading behavior by obtaining information on specific loans a CLO trades, trade dates, prices and face amount traded. There are 1,016,658 unique trades (loan sales and purchases) by 1,255 CLOs over the 2008-2017 period (all CLOs in our sample are actively managed). Since the loan trade and CLO distribution dates differ, we match the loan trade dates to the first CLO distribution quarter-end date after the loan trade date to estimate a CLO's quarterly portfolio rebalancing. Descriptive statistics on CLO origination, reporting and CLOs' loan trading activity by year are summarized in Table 1.

We divide variables constructed from the payment, portfolio and performance CLO reports covered by CLO-i into CLO test restrictiveness variables, CLO equity returns and CLO portfolio characteristics variables, and variables describing the CLO trading activity. These variables are described in detail below.

3.2. Variable definitions

3.2.1. Measures of CLO test restrictiveness

We focus on four important CLO tests: the minimum overcollateralization test, the minimum interest coverage test, the maximum weighted average rating (WARF) test, and the minimum weighted average spread (WAS) test. We measure the restrictiveness of each test by estimating a standardized score of how restrictive a CLO test threshold is relative to the distribution of this test

this test. Indeed, this test is violated for over 40% of our sample CLOs without any adverse consequences for the CLO manager and equity investors (untabulated summary statistic).

threshold in other sample CLOs. To exemplify, we measure a CLO's overcollateralization test restrictiveness by taking the difference between the overcollateralization threshold in this CLO and the minimum threshold of this test across all sample CLOs, scaled by the difference between the maximum and the minimum overcollateralization test thresholds (*Capital coverage restrictiveness*). We employ the same methodology to measure the relative restrictiveness for the CLO interest coverage test (*Interest coverage restrictiveness*) and the CLO WAS test (*Income restrictiveness*). We assess the relative restrictiveness of a CLO's WARF test by taking the difference between the maximum WARF threshold across all sample CLOs and the WARF threshold in this CLO, scaled by the difference between the maximum and the minimum WARF test thresholds (*Risk restrictiveness*). This measurement approach allows us to estimate a standardized average restrictiveness for each CLO test at the CLO level, despite the fact that the unit measurement of these tests and their distribution differ significantly.[9] Finally, we define *CLO test restrictiveness* as the mean value across the *Capital coverage, Income coverage, Risk* and *Income restrictiveness* variables. We provide detailed variable definitions in the Appendix.

Table 2 reports the summary statistics of the variables we use in the empirical analyses. The mean *CLO test restrictiveness* is about 0.45, with a mean *Capital coverage restrictiveness* and *Interest coverage restrictiveness* of 0.30 and 0.59 respectively. The mean *Risk restrictiveness* and *Income restrictiveness* is 0.52 and 0.46 respectively. Figure 1 presents the evolution of the CLO test restrictiveness variable computed for our sample of CLOs over time. Following the trend in the securitization market, CLOs originated before the credit crisis exhibit laxer test thresholds.

[9] Our results are robust to using non-standardized measures for CLO test threshold restrictiveness (without averaging across all tests at the CLO level) and when we use indicator variables of whether the tests' thresholds of a CLO rank are in the upper quartile of the tests' threshold distribution, and zero otherwise (untabulated robustness tests). We further show that our results hold when we measure the tightness of CLO test thresholds relative to the initial CLO test scores upon a CLO's inception.

This pattern sharply reversed during the credit crisis and in the years immediately following the securitization market turmoil, when the constraints placed on CLOs became substantially stricter.

3.2.2. Measures of CLO equity returns and CLO performance characteristics

We measure CLO equity returns using the cash distributions a CLO makes to its equity investors. *Equity returns 1* is defined as the annualized cash distributions to equity investors, and *Equity returns 2* is defined as the quarterly cash distributions to equity investors, defined as the ratio of the quarterly cash payments to CLO equity investors to the CLO equity tranche balance outstanding. The mean *Equity returns 1* is 18.26%, while the mean *Equity returns 2* is 4.77% (Table 2). The descriptive statistics also show a significant cross sectional variation in the equity returns. For instance the second quartile of *Equity Returns 1* is 10.46% while the third quartile is 24.57%. Figure 1 shows CLOs' annualized equity returns on a cash-flow basis by the year of CLOs' origination. CLOs originated prior to the credit crisis delivered on average higher distributions to their equity tranche. We reach similar conclusions when we look at the quarterly CLO equity returns (Figure 2). Both figures reveal a negative correlation between the equity returns of a CLO and the restrictiveness of the CLO tests. This conclusion is further supported by Figure 3 where we split the sample of CLOs into three groups based on the level of the CLO test restrictiveness. CLOs with the highest CLO test restrictiveness pay annualized equity returns of close to 16.5% while CLOs with the lowest restrictiveness return about 20% per annum.

We further include several CLO performance and portfolio characteristics in our multivariate analyses that likely affect CLO equity returns. We control for CLO riskiness and portfolio quality using: the percentage of defaulted (*Default bucket*) and CCC-rated (*CCC-rated bucket*) loans in a CLO portfolio; the average rating of the CLO tranches (*CLO tranche rating*), where a loan's rating is defined as a discrete variable that takes the value of 1 for AAA (or Aaa), 2 for AA+ (or Aa1),

and so forth; indicator variables of whether a CLO violates in a quarter its capital coverage test (*Capital coverage violation*), interest coverage test (*Interest coverage violation*), income test (*Income test violation*) and risk test (*Risk test violation*); and the natural logarithm of the CLO's total principal balance outstanding (*CLO size*). The average CLO size is about $490 million. The mean percentage of defaulted (CCC-rated) CLO loans is about 3.00% (6.00%), and the mean CLO note rating is about 5 or A. The mean likelihood of a CLO test violation is relatively low (e.g., the average CLO has violated the capital coverage test in only about 5% of its reporting quarters), with the risk test being the one that is most commonly violated (e.g., an average CLO has violated the risk test in about 25% of its reporting quarters). In addition, we control for the influence of CLO noteholders using the weighted average CLO note coupon (*Weighted average note coupon*); the CLO junior note principal balance outstanding to CLO senior note principal balance outstanding (*Junior to senior note principal balance*); and the number of CLO tranche categories (e.g., senior, senior subordinated, junior subordinated, mezzanine etc.) issued by the CLO (*CLO tranche slicing*). The mean CLO note coupon is 1.14%, the mean percentage of junior CLO tranches is 19.00%, and the mean number of note types issued by a CLO is about 8. Last, we use the natural logarithm of days to maturity (*Days to maturity*) and whether a CLO is originated after the financial crisis using an indicator variable of whether a CLO is originated post 2012 (*Originated post 2012*) to control for intertemporal differences in CLO equity returns and different CLO structural features. The mean *Days to maturity* is about 7 years (with a mean logarithmic transformation of 8), and the majority of our sample CLOs are originated prior to the financial crisis.

3.2.3. Measures of CLO trading activity

We employ a battery of proxies to examine a CLO manager's trading behavior. First, we measure CLO portfolio turnover using the quarterly total balance of loans purchased by a CLO

minus the total balance of loans sold by a CLO in the same quarter, scaled by the CLO's total principal balance outstanding (*Portfolio turnover*). Also, *High trading volume* is an indicator variable of whether a CLO's quarterly trading volume ranks in the upper quartile of trading volume, and zero otherwise. Trading volume is defined as the total balance of loans purchased and sold by a CLO over a quarter, divided by a CLO's total principal balance outstanding.

Second, we assess a CLO's loan reinvestment strategy by the difference between the quarter a CLO sells a loan minus the quarter a CLO purchases the same loan, averaged at the CLO-quarter of loan sales (*Avg. loan holding period*), and the difference between the holding period (in quarters) of loans whose price decreased over the holding period minus the holding period of loans whose price increased, averaged at the CLO-quarter of loan sale (*Avg. holding period of loans with (price decrease -price increase)*). Moreover, we employ the CLO's buy-and-hold returns on its portfolio loans, averaged at the CLO-quarter of loan sales (*Loan returns*).

Third, we measure the riskiness of CLO portfolio turnover using the difference between the quarterly average credit rating of loans sold by a CLO minus the average credit rating of loans purchased by a CLO in the same quarter (*Credit risk of loan sales -credit risk of loan purchases*). An average CLO rebalances about 3% of its portfolio per quarter and holds a loan for about 15 months in its portfolio, earning, on average, a 33.00% buy-and-hold return. A CLO is likely to retain price-increasing and price-decreasing loans for about the same period on average, as well as sell off riskier loans to buy better-quality ones (i.e., the average CLO sells loans with lower credit ratings and buys loans with higher credit ratings).

4. Research design and empirical results

4.1. CLO test restrictiveness, CLO characteristics and CLO note coupon

We first examine CLO characteristics that are related to the CLO test restrictiveness. We use

an OLS model, where the dependent variable is the mean CLO test restrictiveness (*CLO test restrictiveness*):

$$\begin{aligned} \textit{CLO test restrictiveness} = \quad & \alpha + \beta_1 \textit{ Junior to senior bond original balance} + \beta_2 \textit{ CLO original size} \\ & + \beta_3 \textit{ CLO tranche slicing} + \beta_4 \textit{ CLO maturity} \\ & + \beta_5 \textit{ Originated post 2012} + \beta_6 \textit{ CLO original tranche rating} \\ & + \text{CLO manager FE} + \text{CLO arranger FE} \end{aligned} \qquad \text{(Model 1)}$$

The analysis is at the CLO level, and CLO characteristics are measured at the CLO inception. The variables are described in detail in the Appendix. We further include CLO manager (93 unique managers) and arranging bank fixed effects (20 unique arrangers) in the analyses to control for CLO managers' and arranging banks' unique features (e.g., style, skills) that may determine how strict the CLO test thresholds are set. Standard errors are clustered at the CLO level.

We report the tests of the analyses in Table 3, Panel A. In column (I), we find that small-sized CLOs and CLOs with shorter maturities have more restrictive tests, potentially because restrictive test thresholds compensate for less reputable CLO issuances. Moreover, CLO test restrictiveness is positively related to the volume of junior notes issued by a CLO, potentially because restrictiveness likely serves as a protection mechanism to investors whose returns are more vulnerable to CLO portfolio losses. Although we find a statistically significant and positive coefficient on the variable *CLO original tranche rating*, i.e., CLOs with lower-rated notes have more restrictive tests, this association is not economically significant: an interquartile increase in *CLO original tranche rating* increases *CLO test restrictiveness* by about 0.36% of the mean value of the variable. Last, CLOs issued post the recent credit crisis have on average more restrictive tests. In columns (II)-(V), we show that these findings hold for most CLO test categories. We note that the inverse results documented for *Risk restrictiveness* are driven by the fact that this test is technically the inverse of the *Income restrictiveness* and the other tests, e.g. when a CLO is

restricted on the proportion of risky loan investments the CLO is allowed to hold, the weighted average spread test threshold is mechanically lower.

Furthermore, we examine the relation between *CLO test restrictiveness* and the coupon premium offered to junior noteholders relative to the one paid on the senior tranches. To do so, we augment Model 1 with the *CLO test restrictiveness* variable and use as the dependent variable the difference between a CLO's junior note coupon and the senior note coupon, scaled by the senior note coupon (*Junior coupon premium*). All other control variables and model specifications are the same as in Model 1. We report the results of this test in Panel B of Table 3. We find a negative and statistically significant coefficient on *CLO test restrictiveness* (column I), consistent with junior noteholders exchanging cash flow rights (higher note coupons) for greater control rights (tighter CLO tests). This finding applies to most CLO test categories (column II-V). In untabulated analyses, we find no relation between *CLO test restrictiveness* and the average CLO coupon rate, suggesting that CLO test restrictiveness is unlikely to be driven by the CLOs' portfolio credit risk. Overall, our findings from the analyses on the determinants of test restrictiveness at the CLO inception suggest that the presence of less senior investors rather than underlying risk likely influences CLO test threshold levels.

4.2. CLO test restrictiveness and CLO equity returns

In our second set of analyses, we explore whether restrictive tests affect subsequent CLO equity returns. We use an OLS model, where the dependent variable is the annualized and quarterly CLO equity returns on a cash-flow basis (*CLO equity returns 1* and *CLO equity returns 2*, respectively).

$$\begin{aligned} \textit{CLO equity returns} = \quad & \alpha + \beta_1 \textit{CLO test restrictiveness} + \beta_2 \textit{CCC-rated bucket} + \beta_3 \textit{Default bucket} \\ & + \beta_4 \textit{CLO tranche rating} + \beta_5 \textit{Weighted average note coupon} \\ & + \beta_6 \textit{Junior to senior bond principal balance} \\ & + \beta_7 \textit{CLO tranche slicing} + \beta_8 \textit{Capital coverage test violation} \\ & + \beta_9 \textit{Interest coverage test violation} + \beta_{10} \textit{Risk test violation} \\ & + \beta_{11} \textit{Income test violation} + \beta_{12} \textit{Originated post 2012} \end{aligned}$$

$+\beta_{13}$*Days to maturity* + β_{14}*CLO size* + CLO manager FE
+CLO arranger FE +Year FE

(Model 2)

The analysis is at the CLO-quarter level. The variables are described in detail in the Appendix. We further include year, CLO manager (93 unique managers) and arranging bank fixed effects (20 unique arrangers) in the analyses to control for time-varying changes in market conditions, CLO managers' and arranging banks' unique features (e.g., style, skills) that may influence CLO equity returns. Standard errors are clustered at the CLO level.

We report the tests of the analyses in Table 4. In Panel A (Panel B), we present the results using *Equity returns 1* (*Equity returns 2*) as the dependent variable. Across both panels, we find a negative and statistically significant coefficient on *CLO test restrictiveness* (column I), suggesting that CLOs with more restrictive tests offer on average lower quarterly returns to their equity investors. Economically, an interquartile increase in *CLO test restrictiveness* decreases annualized (quarterly) CLO equity returns by about 6.00% (8.10%) of the mean value of the dependent variable. These results hold for almost all CLO test categories (columns II-VI).

In terms of the coefficients on the control variables, we find that CLOs that experience more loan defaults, have a larger CCC-rated loan bucket or fail to pass the CLO test thresholds offer on average lower CLO equity returns, consistent with a deterioration in CLO portfolio quality primarily affecting the distributions to CLO equity investors. Moreover, high CLO coupon rates negatively affect CLO equity returns, while larger CLOs or CLOs with greater volume of junior notes experience higher equity returns, potentially because these CLOs are more reputable or more attentive to CLO portfolio quality so that they deliver higher performance to their CLO junior noteholders.

We next examine whether this negative association between *CLO test restrictiveness* and CLO

equity returns is priced by CLO noteholders and equity investors. To do so, we augment Model 2 using as dependent variable the natural logarithm of the trading price of a CLO note (equity) tranche (*CLO note price* [*CLO equity price*]) and further controlling for the natural logarithm of the CLO note (equity) tranche principal balance traded (*CLO bond tranche amount traded* [*CLO equity tranche amount traded*]), the average credit rating of the CLO note tranches traded (*Rating of CLO note tranche traded*) and CLO tranche seniority fixed effects. All other control variables and model specifications are the same as in Model 2.

We report the results of the tests in Table 5. We find that CLO note pricing is greater for CLOs with more restrictive tests (column I and II), however, the results are not economically significant. An interquartile increase in *CLO test restrictiveness* increases *CLO note price* by about 0.30% of the mean value of the dependent variable. In contrast, despite the significant drop in sample size due to the fact that the CLO equity tranche is relatively illiquid, we find a negative and statistically significant coefficient on *CLO test restrictiveness* when the dependent variable is *CLO equity price* (columns III-IV). Economically, an interquartile increase in *CLO test restrictiveness* decreases *CLO equity price* by about 2.01% of the mean value of the dependent variable. Overall, our evidence suggests that CLOs with more restrictive tests offer lower distributions on a cash-flow basis to CLO equity investors, and this adverse effect seems to be priced –at least, to some extent– by CLO equity investors.

4.3. CLO test restrictiveness, CLO equity returns and CLO trading activities

In our third set of analyses, we attempt to identify possible mechanisms that link CLO test restrictiveness to lower CLO equity returns. Focusing on trading choices made by CLO managers, on the one hand, CLO test restrictiveness may discipline managers' risk-taking activities, i.e., CLO managers may decrease risky loan investments and avoid frequent portfolio rebalancing to

alleviate the likelihood of incurring a test violation (e.g., Helwege et al., 2016). Thus, the presence of restrictive CLO tests can be associated with lower portfolio volatility and risk, which subsequently reduces CLO equity returns. On the other hand, CLO managers generally strive to meet the test thresholds on a monthly and quarterly basis, thus, test restrictiveness places a higher hurdle on them to achieve the necessary short-term performance to pass these tests. To do so, CLO managers may prefer to invest in loans that will offer them these short-term profits, potentially sacrificing long-term performance and investment upside potentials. To exemplify, CLO managers may prefer to invest in riskier loans that offer higher income or hold loans until their price just appreciates to sell them immediately afterwards and cash the gains. Holding well-performing loans for longer periods will not allow managers to realize their investment gains to pass regular binding tests or may place more constraints on them to closely monitor potential future loan performance volatility and deterioration. In contrast, CLO managers facing laxer tests are not affected by intertemporal volatility in loan performance, thus, can hold well-performing loans for longer periods.

To examine the relation between CLO test restrictiveness and CLO trading activities, we employ Model 2 using as dependent variables the trading activity measures described in Section 3.2.3. All other model specifications and control variables are the same as in Model 2. We report the results of these tests in Table 6. In columns I and II, we find a positive and statistically significant coefficient on *CLO test restrictiveness*, suggesting that CLOs with more restrictive tests exhibit higher portfolio turnover and volatility. Economically, an interquartile increase in *CLO test restrictiveness* increases *Portfolio turnover* and *High trading volume* by about 17.00% and 14.00% of the mean value of the dependent variables, respectively. Relatedly, CLOs with more restrictive tests on average hold portfolio loans for shorter time periods, thus, pursuing shorter investment

horizons (column III). Economically, an interquartile increase in *CLO test restrictiveness* decreases *Avg. loan holding period* by about 2.00% of the mean value of the dependent variable (i.e., by about 12 days). Importantly, this greater portfolio turnover is not driven by CLO managers trying to dispose low-quality loans.[10] In columns IV and V, we show that CLOs with more restrictive tests are likely to sell-off well-performing loans faster (i.e., loans whose market price appreciates over time) and retain underperforming loans (i.e., loans whose market price has decreased below the purchase price). Economically, an interquartile increase in *CLO test restrictiveness* increases the *Avg. holding period of loans with (price decrease -price increase)* by about 26.00% (i.e. by about 24 days). As a result, the average buy-and-hold loan portfolio returns are significantly lower for CLOs with restrictive tests (column V): an interquartile increase in *CLO test restrictiveness* decreases the *Loan returns/profits* by about 11.00%, which represents 33.00% of the mean value of the dependent variable. In addition, we show that CLO test restrictiveness is positively associated to the riskiness of loans purchased by a CLO relative to the riskiness of loans sold by the CLO (column VI). Economically, an interquartile increase in *CLO test restrictiveness* decreases *Credit risk of loan sales -credit risk of loan purchases* by about 16.00% of the mean value of the dependent variable. Our findings are robust to examining the association between the restrictiveness of individual CLO test categories and CLOs' trading activities (untabulated tests).

Overall, CLO managers facing more restrictive constraints rebalance their loan investments to a greater extent and more frequently, as well as liquidate their profitable investments sooner and purchase riskier new investments to circumvent these binding tests. Our findings are consistent with the interpretation that these CLO managers will change their investment and trading strategy to meet these tests, which will have a detrimental effect on CLO equity returns.

[10] Sample size drops because the complete holding period is not available for all portfolio loans, i.e. many portfolio loans were purchased or sold by CLOs outside our sample period.

To provide additional evidence on the effect of the trading choices by CLOs with more restrictive tests on CLO equity returns, we augment Model 2 with the measures of CLO trading activities and their interaction terms with *CLO test restrictiveness*. All other model specifications and control variables are the same as in Model 2. We report the results of these tests in Table 7 using *Equity returns 1* (Panel A) and *Equity returns 2* (Panel B) as the dependent variables. Across most specifications in both panels, we find that while CLO trading activities on average improve CLO equity returns, trading activities by CLOs with restrictive tests adversely affect the distributions to CLO equity investors. To exemplify, an interquartile increase in *Portfolio turnover* increases *CLO equity returns 1* (*CLO equity returns 2*) by about 6.00% (5.60%) of the mean value of the dependent variable. However, when a CLO tests' restrictiveness ranks in the upper quartile of the variable distribution, an interquartile increase in *Portfolio turnover* decreases *CLO equity returns 1* (*CLO equity returns 2*) by about 2.10% (3.00%) of the mean value of the dependent variable. These findings provide further support on the adverse effects of trading activities by CLOs with more restrictive tests on the CLO distributions to the equity tranche.

4.4. Supplemental analyses

4.4.1. CLO test restrictiveness and CLO portfolio default risk

In supplemental analyses, we examine whether our results are likely driven by the higher likelihood of more constrained CLOs defaulting on their tests or exhibiting lower portfolio credit performance. Thus, a CLO's test restrictiveness may be correlated with an unobservable inherent risk factor of the CLO that also suppresses CLO equity returns. To alleviate this concern, we employ Model 2 using as dependent variables measures of CLO's ex-post performance. *CLO test slack* is the average standardized slack across CLO tests (capital coverage, interest coverage, income and risk). CLO test slack is the percentage difference between the CLO test score minus

the CLO test threshold (CLO test threshold minus the CLO test score for the risk test). The CLO test slack is then standardized based on the distribution of this variable. *Probability of 5% CLO test slack* is an indicator variable of whether the slack of a CLO test is between 0% and 5%, and zero otherwise. *CLO tranche rating downgrade* is an indicator variable of whether a CLO tranche has been downgraded by at least one notch since previous quarter, and zero otherwise. *Default bucket* (*CCC-rated bucket*) is defined as the percentage of defaulted (CCC-rated).[11]

We present the results of these tests in Table 8. Across all specifications, we fail to find a statistically significant coefficient on *CLO test restrictiveness*, consistent with the argument that CLOs with more restrictive tests are not inherently riskier. This evidence provides further support that CLO managers engage in more short-term loan investments and portfolio rebalancing to alleviate default costs associated with violating a test threshold. Importantly, these findings further suggest that CLO test restrictiveness does not seem to directly benefit CLO noteholders either, since constrained CLOs do not exhibit on average superior credit performance or lower ex-post credit risk.

Moreover, we investigate whether our results are robust to an alternative measure of CLO test restrictiveness. Following Demiroglu and James (2010), we measure CLO test restrictiveness by how close a test threshold is set relative to the level of the test score at the inception of the CLO. Focusing on CLOs originated post 2009, we measure the initial slack of the capital coverage, interest coverage, risk and income test by the ratio: [(test score up to one quarter post CLO origination- test threshold)/ test threshold].[12] We then average initial slack across all tests. *Lax*

[11] For specifications where *CLO test slack* and *Probability of 5% CLO test slack*, are used as the dependent variables, the CLO test violation variables are excluded from the control variables. For specifications where *Default bucket* (*CCC bucket*) is the dependent variable, the variable *Default bucket* (*CCC bucket*) is excluded from the control variables. All other model specifications and control variables are the same as in Model 2.

[12] Sample size drops because test scores upon CLO origination are not available for all CLOs in our sample. The restricted sample for this test includes 311 unique CLOs.

CLO test restrictions upon origination is an indicator of whether a CLO's initial average test slack is ranked in the upper quintile of the distribution, and zero otherwise. We employ Model 2 where *Lax CLO test restrictions upon origination* is the measure of CLO test restrictiveness and the primary independent variable of interest. All other model specifications and control variables are the same as in Model 2. We present the results of these tests in Table 9. We show that the results of our primary analyses remain unchanged, suggesting that our findings are unlikely to be driven by our measurement choices for CLO test restrictiveness.

5. Conclusion

We explore whether the loan portfolio constraints (or tests) imposed on CLOs upon their origination predict future CLO equity returns. We focus on CLO tests that determine the minimum capital and interest coverage on CLO notes, the minimum interest income from portfolio loans' interest payments and maximum portfolio riskiness (i.e., minimum average rating of portfolio loans). We show that small-sized CLOs, CLOs originated after the credit crisis and CLOs with larger junior noteholders' presence have more restrictive CLO test thresholds.

Looking at CLO's distributions to the equity tranche (i.e., realized equity returns on a cash-flow basis), we show that CLOs with more restrictive test thresholds offer lower returns to their equity-holders. We find some evidence that these adverse effects of CLO constraints are priced when CLO equity tranches are traded. Further, we examine trading activities by constrained CLOs that likely contribute to the lower CLO equity returns. We show that CLOs with more restrictive tests exhibit higher CLO portfolio volatility and turnover. They are also more likely to hold loans for shorter periods, liquidate profitable loan investments more quickly to cash the gains. Therefore, CLOs with more restrictive tests achieve lower buy-and-hold loan returns relative to CLOs with laxer test thresholds. Our findings are consistent with the interpretation that CLO managers facing

restrictive constraints will adopt a more short-term oriented investment and trading strategy to meet these tests, which negatively affects the CLOs' equity returns. Last, we show that our results are unlikely to be driven by the higher default costs of CLOs with tighter constraints and are robust to alternative definitions of CLO test restrictiveness.

Our findings provide insights to CLOs' structural features determined upon their origination that can inform CLO equity investors on their average future expected returns. We further document that greater constraints placed by regulators on CLOs, especially after the credit crisis, are likely at a cost to the equity investors (hedge funds, insurance firms and CLO managers). Nevertheless, we acknowledge that our findings preclude us from drawing conclusions on the optimality of CLOs' trading behavior, since CLO equity returns could be even lower if CLO managers do not adopt an active short-term loan investment strategy and let the CLO default on the tests. Moreover, our data availability restricts us from examining whether equity ownership by the CLO manager can mitigate the adverse effects of CLO constraints. More research is required to understand the role of CLOs' structural features in influencing investors' returns and CLO managers' trading strategies.

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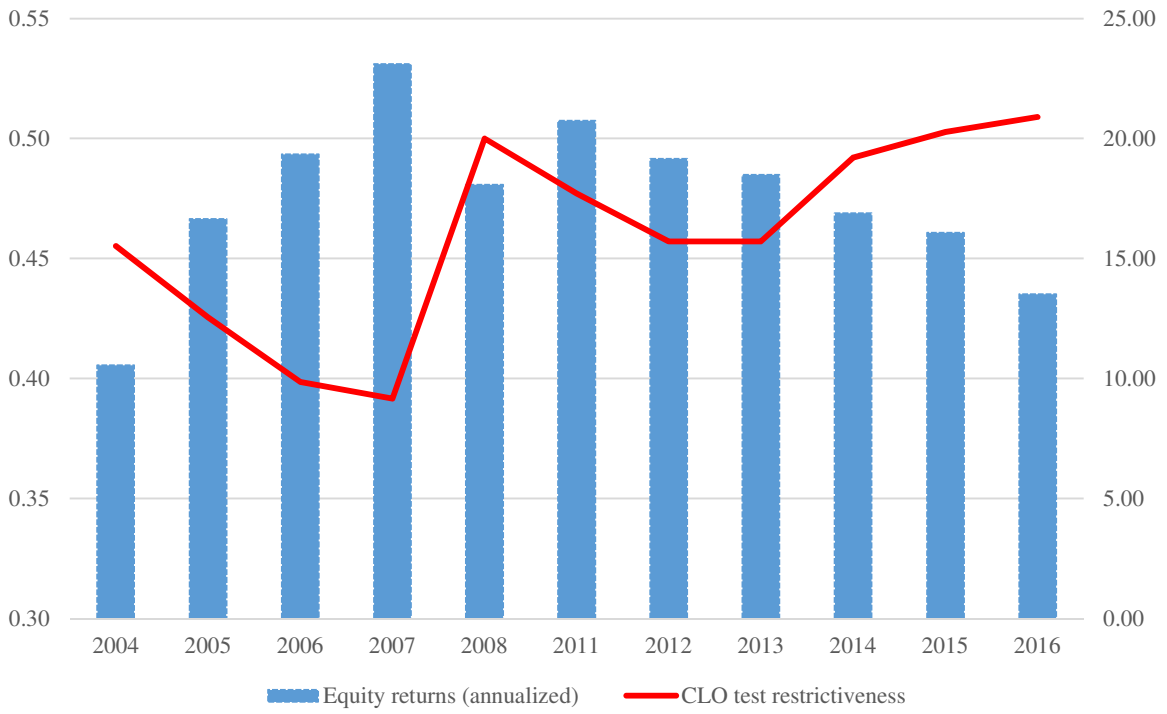
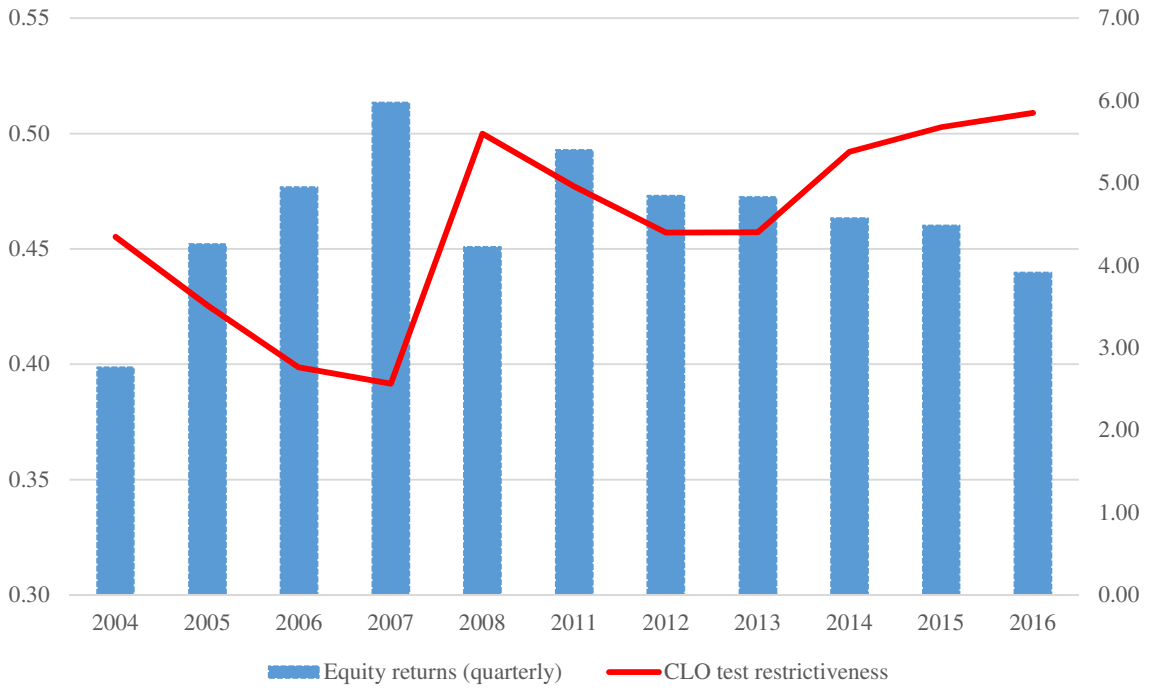
Figure 1. CLO test restrictiveness and annualized equity returns by year of CLO origination



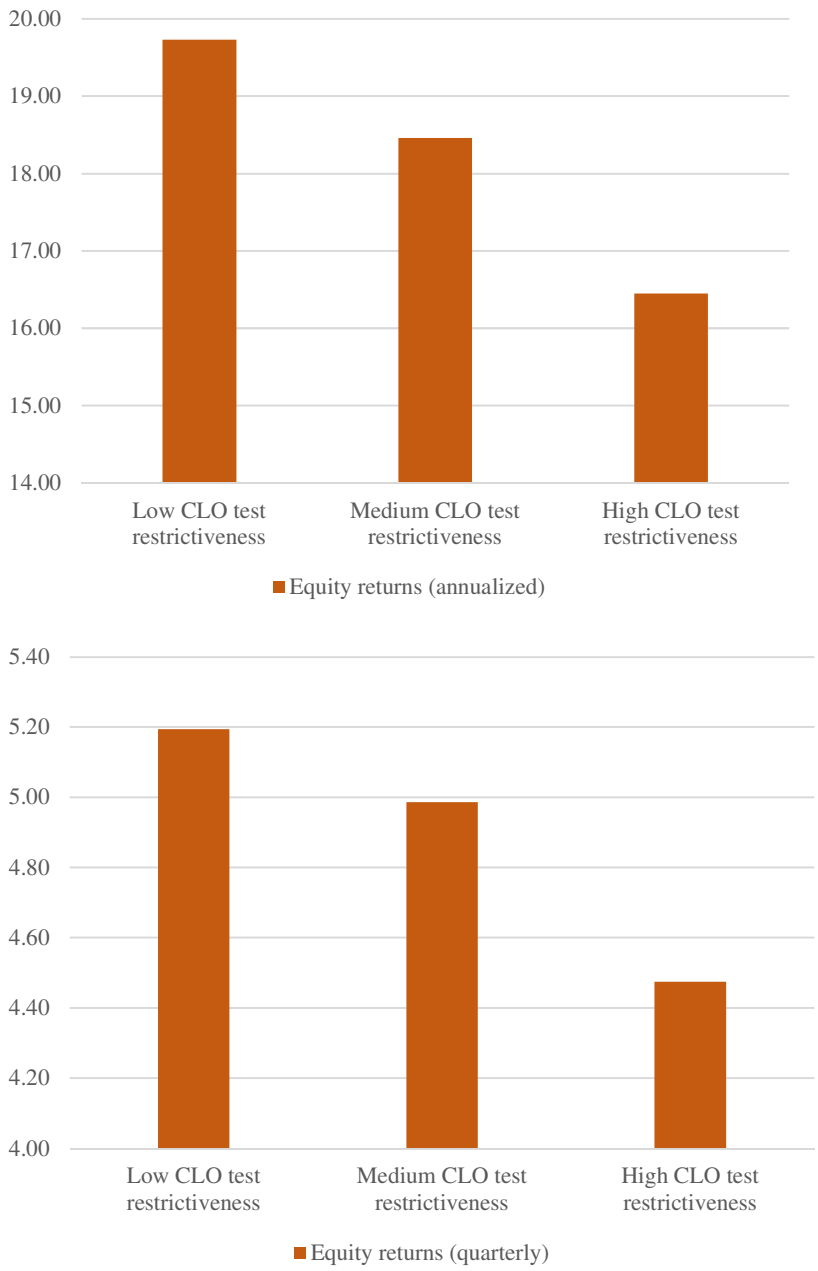
The figure presents the restrictiveness of CLO tests (primary y-axis) and the percentage of annualized CLO equity returns on a cash-flow basis (secondary y-axis) by year of CLO origination over the period 2004-2016. There are no CLOs originated in 2009, and only one CLO was issued in 2010, thus, these two years are omitted.

Figure 2. CLO test restrictiveness and quarterly equity returns by year of CLO origination



The figure presents the restrictiveness of CLO tests (primary y-axis) and the percentage of quarterly CLO equity returns on a cash-flow basis (secondary y-axis) by year of CLO origination over the period 2004-2016. There are no CLOs originated in 2009, and only one CLO was issued in 2010, thus, these two years are omitted.

Figure 3. Annualized and quarterly equity returns by CLO test restrictiveness



The figure presents the average annualized CLO equity returns (first graph) and quarterly CLO equity returns (second graph) on a cash-flow basis by tercile of test restrictiveness of our sample CLOs.

APPENDIX

Variable definition

Variable	Definition
CLO test restrictiveness	
Capital coverage restrictiveness	The standardized measure for a CLO's minimum senior or junior note capital coverage (overcollateralization) test restrictiveness, defined as: [CLO's capital threshold - Min(Capital threshold)/Max(Capital threshold) - Min(Capital threshold)].
Interest coverage restrictiveness	The standardized measure for a CLO's minimum senior or junior note interest coverage test restrictiveness, defined as: [CLO's interest threshold -Min(Interest threshold)/Max(Interest threshold) -Min(Interest threshold)].
Risk restrictiveness	The standardized measure for a CLO's maximum average portfolio loans' credit rating test restrictiveness, defined as: [Max(Risk threshold) -CLO's risk threshold/Max(Risk threshold) -Min(Risk threshold)].
Income restrictiveness	The standardized measure for a CLO's minimum average portfolio loan spread test (income test) restrictiveness, defined as: [CLO's income threshold -Min (Income threshold)/Max(Income threshold) -Min(Income threshold)].
CLO test restrictiveness	The mean of *Capital coverage, Income coverage, Risk* and *Income restrictiveness.*
CLO equity returns	
Equity returns 1	CLO quarterly equity returns based on the distributions to equity holders (variable from CLOi)
Equity returns 2	The percentage of quarterly dividends to equity holders divided by the CLO equity par value.
Equity and note pricing	
CLO note price	The natural logarithm of the trading price of a CLO senior or junior note tranche, averaged at the CLO tranche-quarter level.
CLO equity price	The natural logarithm of the trading price of a CLO equity tranche, averaged at the CLO tranche-quarter.
CLO note tranche amount traded	The natural logarithm of CLO note tranche principal balance traded, averaged at the CLO tranche-quarter.
CLO equity tranche amount traded	The natural logarithm of CLO equity tranche principal balance traded, averaged at the CLO tranche- quarter.
Rating of CLO note tranche traded	The credit rating of CLO note tranche traded, averaged at the CLO tranche-quarter level. CLO tranche rating is a scale variable equal to 1 if the rating is AAA, 2 if AA+, and so forth.

APPENDIX (Continued)

Trading activities	
Portfolio turnover	The quarterly total balance of loans purchased by a CLO minus the total balance of loans sold by a CLO in the same quarter, divided by a CLO's total principal balance outstanding.
High trading volume	Binary variable equal to one if a CLO's quarterly trading volume ranks in the upper quartile of trading volume, and zero otherwise. Trading volume is defined as the total balance of loans purchased and sold by a CLO over a quarter, divided by a CLO's total principal balance outstanding.
Avg. loan holding period	The difference between the quarter a CLO sells a loan minus the quarter a CLO purchased the same loan, averaged at the CLO-quarter of loan sale.
Avg. holding period of loans with (price decrease -price increase)	The difference between the holding period of loan whose price decreased over the holding period minus the holding period of loan whose price increased, averaged at the CLO-quarter of loan sale.
Loan returns/profits	Returns that a CLO generates for buying and selling a loan, averaged at the CLO-quarter of sales level. Returns are defined as: (Balance of loan sold*Sale price -Balance of loan purchased*Purchase price)/(Balance of loan purchased*Purchase price).
Credit risk of loan sales -credit risk of loan purchases	The difference between the the quarterly average credit rating of loans sold by a CLO minus the average credit rating of loans purchased by a CLO in the same quarter. Loan rating is a scale variable equal to 1 if the loan rating is AAA, 2 if AA+, and so forth.
CLO performance & characteristics (at the CLO-quarter level)	
CCC bucket	The principal balance of CCC-rated CLO portfolio loans to CLO total principal balance outstanding.
Default bucket	The principal balance of defaulted CLO portfolio loans to CLO total principal balance outstanding.
CLO tranche rating	The mean credit rating of CLO tranches. CLO tranche rating is a scale variable equal to 1 if the rating is AAA, 2 if AA+, and so forth.
Weighted average note coupon	Weighted average coupon rate of the CLO senior and junior note tranches.
Junior to senior note principal balance	CLO junior note principal balance outstanding to CLO senior note principal balance outstanding.
Capital coverage test violation	Binary variable equal to one if a CLO violated the senior or junior capital coverage test threshold, and zero otherwise.

APPENDIX (Continued)

Interest coverage test violation	Binary variable equal to one if a CLO violated the senior or junior interest coverage test threshold, and zero otherwise.
Risk test violation	Binary variable equal to one if a CLO violated the risk test threshold, and zero otherwise.
Income test violation	Binary variable equal to one if a CLO violated the income test threshold, and zero otherwise.
Originated post 2012	Binary variable equal to one if the CLO is originated post 2012 (i.e., when the managers of new CLOs are required to abide by risk-retention rules), and zero otherwise.
Days to maturity	The natural logarithm of days till the CLO matures (for CLOs that are called early by their investors, the variable is defined as the natural logarithm of days till the CLO is called).
CLO size	The natural logarithm of CLO total principal balance outstanding.
CLO performance & characteristics (at the CLO level)	
Junior coupon premium	CLO junior note coupon minus senior note coupon, divided by senior note coupon.
CLO maturity	The natural logarithm of CLO maturity in years
CLO original tranche rating	The mean credit rating of CLO tranches upon CLO origination. CLO tranche rating is a scale variable equal to 1 if the rating is AAA, 2 if AA+, and so forth.
Originated post 2012	Binary variable equal to one if the CLO is originated post 2012 (i.e., when the managers of new CLOs are required to abide by risk-retention rules), and zero otherwise.
CLO tranche slicing	The number of CLO tranches issued by the CLO.
Junior to senior CLO note original balance	CLO junior note principal balance to CLO senior note principal balance at CLO origination.
CLO equity balance	CLO junior note principal balance to CLO senior note principal balance at CLO origination.
CLO original size	The natural logarithm of CLO total principal balance upon origination.

TABLE 1

Sample statistics

Year	(I) Number of unique CLOs	(II) Number of CLO-quarter observations	(III) Number of loan trades
2008	194	494	8,612
2009	224	888	48,769
2010	329	1,133	75,917
2011	350	1,312	76,522
2012	348	1,258	52,317
2013	422	1,381	57,332
2014	547	1,674	74,834
2015	699	2,349	139,214
2016	725	2,498	207,493
2017	878	2,724	275,638

This table presents the number of unique CLOs per reporting year (column I), the number of CLO-quarter observations in our sample per reporting year (column II), and the number of unique loan trades (sales and purchases) by CLOs per reporting year (column III).

TABLE 2

Descriptive statistics

Panel A: Summary statistics of variables used at the CLO-level analyses on the relation between CLO test and CLO characteristics

Variable	Obs.	Mean	S.D.	Q2	Median	Q3
CLO test restrictiveness	1,255	0.45	0.08	0.41	0.46	0.52
Capital coverage restrictiveness	1,255	0.30	0.19	0.23	0.33	0.45
Interest coverage restrictiveness	1,255	0.59	0.13	0.52	0.59	0.65
Risk restrictiveness	1,255	0.52	0.20	0.34	0.47	0.60
Income restrictiveness	1,255	0.46	0.20	0.30	0.49	0.57
Junior coupon premium	1,255	9.20	5.34	5.95	8.40	11.78
CLO maturity	1,255	2.52	0.17	2.43	2.56	2.64
CLO original tranche rating	1,255	5.16	1.72	4.50	5.33	6.20
Originated post 2012	1,255	0.63	0.48	0.00	1.00	1.00
CLO tranche slicing	1,255	8.18	2.11	7.00	8.00	9.00
Junior to senior note original balance	1,255	0.18	0.07	0.12	0.17	0.23
CLO equity balance	1,255	0.10	0.05	0.08	0.10	0.13
CLO original size	1,255	20.23	0.45	19.84	20.15	20.54

Panel B: Summary statistics of variables used at the CLO-quarter level analyses on the relation between CLO tests and CLO equity returns and trading activities

Variable	Obs.	Mean	S.D.	Q2	Median	Q3
Equity returns 1	15,711	18.26	11.83	10.46	17.63	24.57
Equity returns 2	15,711	4.77	2.97	2.73	4.58	6.43
CLO test restrictiveness	15,711	0.44	0.07	0.38	0.43	0.48
Capital coverage restrictiveness	15,711	0.27	0.17	0.13	0.22	0.36
Interest coverage restrictiveness	15,711	0.59	0.12	0.52	0.59	0.65
Risk restrictiveness	15,711	0.54	0.20	0.39	0.54	0.70
Income restrictiveness	15,711	0.35	0.20	0.19	0.31	0.52
CCC bucket	15,711	0.06	0.05	0.03	0.05	0.08
Default bucket	15,711	0.03	0.09	0.00	0.01	0.02
CLO tranche rating	15,711	5.48	2.10	5.00	5.44	6.00
Weighted average note coupon	15,711	1.14	0.74	0.47	0.67	1.94
Junior to senior note principal balance	15,711	0.19	0.07	0.10	0.15	0.22
CLO tranche slicing	15,711	8.18	2.07	7.00	8.00	9.00
Capital coverage CLO test violation	15,711	0.05	0.23	0.00	0.00	0.00
Interest coverage CLO test violation	15,711	0.02	0.14	0.00	0.00	0.00
Risk CLO test violation	15,711	0.25	0.43	0.00	0.00	0.00
Income CLO test violation	15,711	0.07	0.25	0.00	0.00	0.00
Originated post 2012	15,711	0.41	0.49	0.00	0.00	1.00
Days to maturity	15,711	7.99	0.46	7.72	8.00	8.22

TABLE 2 (Continued)

CLO size	15,711	19.74	1.06	19.60	19.89	20.10
Portfolio turnover	15,711	0.03	0.08	0.00	0.03	0.07
High trading volume	15,711	0.26	0.47	0.00	0.00	1.00
Avg. loan holding period	11,458	5.28	1.50	4.86	5.62	6.18
Avg. holding period of loans with (price decrease -price increase)	11,458	0.00	2.41	-1.30	0.13	1.46
Loan returns/profits	11,458	0.33	1.11	-0.39	0.02	0.58
Credit risk of loan sales -credit risk of loan purchases	12,152	1.54	5.71	-0.11	0.41	1.34
CLO note price	6,573	4.51	0.14	4.50	4.57	4.60
CLO note tranche amount traded	6,573	1.51	0.68	1.10	1.42	1.80
Rating of CLO note tranche traded	6,573	8.23	5.50	3.00	9.00	12.00
CLO equity price	854	4.21	0.26	3.91	4.24	4.41
CLO equity tranche amount traded	854	1.65	0.70	1.13	1.61	2.08

This table presents descriptive statistics for the variables used in our primary tests. The values of the continuous variables are winsorized at 1% and 99%. Variables are described in Appendix.

TABLE 3

CLO test restrictiveness, CLO characteristics and spread

Panel A: The relation between CLO test restrictiveness and CLO characteristics

Variable	(I) *CLO test restrictiveness*	(II) *Capital coverage restrictiveness*	(III) *Interest coverage restrictiveness*	(IV) *Risk restrictiveness*	(V) *Income restrictiveness*
Junior to senior note original balance	0.201***	0.927***	0.161**	-0.753***	0.526***
	(5.129)	(10.813)	(1.975)	(-7.129)	(6.236)
CLO original size	-0.014**	-0.010	-0.002	-0.017	-0.033***
	(-2.113)	(-0.573)	(-0.133)	(-1.210)	(-3.010)
CLO tranche slicing	-0.000	-0.002	-0.001	-0.001	0.001
	(-0.269)	(-1.079)	(-0.405)	(-0.478)	(0.660)
CLO maturity	-0.051***	-0.170***	-0.039*	0.104***	-0.100***
	(-3.485)	(-6.016)	(-1.707)	(3.318)	(-4.082)
Originated post 2012	0.017***	0.080***	-0.071***	-0.165***	0.224***
	(2.661)	(5.664)	(-5.528)	(-10.420)	(16.491)
CLO original tranche rating	0.001***	-0.000	0.001**	0.003***	0.001*
	(5.040)	(-0.059)	(2.450)	(5.424)	(1.875)
Adj- R^2	53.79%	73.66%	28.94%	60.55%	76.36%
Obs.	1,255	1,255	1,255	1,255	1,255

TABLE 3 (Continued)

Panel B: The relation of CLO test restrictiveness and CLO coupon premium

	Junior coupon premium					
Variable	(I)	(II)	(III)	(IV)	(V)	(VI)
CLO test restrictiveness	**-12.228*** **					
	(-5.367)					
Capital coverage restrictiveness		**-8.048*** **				**-6.674*** **
		(-6.198)				**(-5.082)**
Interest coverage restrictiveness			**-2.247***			**-1.215**
			(-1.843)			**(-1.008)**
Risk restrictiveness				**0.800**		**-0.902**
				(0.870)		**(-0.988)**
Income restrictiveness					**-7.260*** **	**-4.903*** **
					(-5.366)	**(-3.894)**
CLO maturity	2.950***	2.263***	3.854***	3.782***	2.614***	2.463***
	(3.531)	(2.727)	(4.432)	(4.580)	(3.140)	(2.956)
CLO original tranche rating	0.090***	0.073***	0.078***	0.069***	0.079***	0.081***
	(5.939)	(5.095)	(5.232)	(4.501)	(5.421)	(5.352)
Originated post 2012	-6.823***	-6.475***	-7.131***	-6.865***	-5.550***	-5.762***
	(-14.578)	(-13.787)	(-14.674)	(-13.754)	(-9.860)	(-10.602)
CLO tranche slicing	0.461***	0.459***	0.479***	0.447***	0.476***	0.451***
	(7.078)	(7.125)	(7.304)	(6.688)	(7.421)	(6.787)
Junior to senior note original balance	29.533***	36.160***	27.471***	29.475***	30.806***	36.193***
	(9.011)	(10.186)	(8.540)	(8.752)	(9.594)	(9.963)
CLO original size	-1.818***	-1.853***	-1.793***	-2.047***	-1.803***	-1.658***
	(-4.710)	(-5.010)	(-4.468)	(-5.054)	(-4.584)	(-4.217)
Adj- R^2	55.89%	57.44%	53.05%	55.67%	56.97%	57.43%
Obs.	1,255	1,255	1,255	1,255	1,255	1,255

This table reports the analyses of the relation between CLO test restrictiveness and CLO characteristics. Panel A reports the tests on the determinants of CLO test restrictiveness. Panel B reports the tests on the effect of CLO test restrictiveness on the CLO junior note premium. Variables are defined in Appendix. The values of the continuous variables are winsorized at 1% and 99%. CLO manager and arranger fixed effects are included but not tabulated. A constant is included but not tabulated. OLS regressions are used to estimate the models, with T-statistics reported in parentheses. Standard errors are corrected for heteroskedasticity and clustered at the CLO level. ***, ** and * denote significance at the 1%, 5% and 10% (two-sided) levels, respectively.

TABLE 4

CLO test restrictiveness and CLO equity returns

Panel A: The relation between CLO test restrictiveness and CLO annualized distributions to equity-holders.

	Equity returns 1					
Variable	(I)	(II)	(III)	(IV)	(V)	(VI)
CLO test restrictiveness	**-10.012*** **					
	(-3.203)					
Capital coverage restrictiveness		**-7.669*** **				**-8.041*** **
		(-3.787)				**(-3.252)**
Interest coverage restrictiveness			**-0.981**			**1.172**
			(-0.627)			**(0.673)**
Risk restrictiveness				**-3.734** **		**-4.839*** **
				(-2.345)		**(-3.102)**
Income restrictiveness					**-3.139***	**-3.016**
					(-1.735)	**(-1.431)**
CCC bucket	-12.824***	-9.827**	-12.459**	-37.085***	-10.897	-11.536*
	(-2.712)	(-2.109)	(-2.556)	(-4.562)	(-1.556)	(-1.653)
Default bucket	-8.723***	-7.987***	-8.773***	3.985	-6.034**	-4.414
	(-4.175)	(-3.788)	(-3.932)	(1.123)	(-2.249)	(-1.551)
CLO tranche rating	0.178**	0.178**	0.205***	-0.161	0.184**	0.150*
	(2.226)	(2.232)	(2.606)	(-1.468)	(1.988)	(1.664)
Weighted average note coupon	-1.564***	-0.999*	-1.982***	-1.426***	-1.356	-0.253
	(-2.738)	(-1.771)	(-3.373)	(-2.894)	(-1.630)	(-0.302)
Junior to senior note principal balance	6.204*	10.186***	6.170*	8.730*	7.505*	11.932***
	(1.831)	(3.098)	(1.839)	(1.839)	(1.762)	(2.995)
CLO tranche slicing	-0.010	-0.016	0.007	-0.067	0.042	-0.024
	(-0.122)	(-0.196)	(0.090)	(-0.723)	(0.480)	(-0.266)
Capital coverage test violation	-9.972***	-10.007***	-9.854***	-10.604***	-10.324***	-10.194***
	(-16.228)	(-16.087)	(-15.110)	(-12.405)	(-15.023)	(-14.054)
Interest coverage test violation	-2.756**	-2.861**	-2.879**	-1.068	-2.098	-2.109
	(-2.448)	(-2.472)	(-2.508)	(-0.515)	(-1.412)	(-1.388)
Risk test violation	-2.514***	-2.797***	-2.558***	-0.484	-2.507***	-2.114***
	(-6.818)	(-7.420)	(-6.641)	(-0.905)	(-5.813)	(-4.945)
Income test violation	-0.294	-0.302	-0.325	0.964	-0.118	0.067
	(-0.702)	(-0.719)	(-0.754)	(1.268)	(-0.234)	(0.130)
Originated post 2012	2.413***	2.358***	2.459***	-1.444**	1.859	1.141
	(2.656)	(2.685)	(2.681)	(-2.223)	(1.547)	(0.952)
Days to maturity	2.787***	2.768***	2.854***	1.510***	2.898***	2.655***
	(8.287)	(8.257)	(8.253)	(2.916)	(7.384)	(6.681)

TABLE 4 (Continued)

CLO size	1.318***	1.333***	1.236***	0.544**	1.262***	1.208***
	(4.170)	(4.123)	(4.402)	(2.518)	(4.402)	(4.110)
Adj- R^2	40.42%	39.61%	39.28%	32.94%	32.47%	40.33%
Obs.	15,711	15,711	15,711	15,711	15,711	15,711

Panel B: The relation between CLO test restrictiveness and CLO quarterly distributions to equity-holders.

				Equity returns 2		
Variable	(I)	(II)	(III)	(IV)	(V)	(VI)
CLO test restrictiveness	**-3.685*** (-4.444)**					
Capital coverage restrictiveness		**-2.124*** (-4.433)**				**-2.157*** (-3.883)**
Interest coverage restrictiveness			**-0.352 (-0.798)**			**0.203 (0.430)**
Risk restrictiveness				**-0.755* (-1.936)**		**-0.819** (-2.206)**
Income restrictiveness					**-1.022** (-2.053)**	**-0.416 (-0.911)**
CCC bucket	-6.323***	-2.981***	-3.599***	-7.005***	-6.303***	-3.387***
	(-4.369)	(-2.789)	(-3.256)	(-4.708)	(-4.322)	(-3.021)
Default bucket	-1.128	-2.266***	-2.706***	-1.212*	-1.186*	-2.234***
	(-1.618)	(-4.783)	(-5.276)	(-1.727)	(-1.658)	(-4.442)
CLO tranche rating	-0.002	0.042**	0.055***	0.017	0.013	0.051***
	(-0.080)	(2.187)	(2.783)	(0.675)	(0.514)	(2.586)
Weighted average note coupon	0.013	-0.077	-0.412***	-0.168	0.030	0.013
	(0.075)	(-0.530)	(-2.917)	(-0.961)	(0.149)	(0.079)
Junior to senior note principal balance	2.717***	2.925***	1.847**	2.002**	2.484**	2.977***
	(2.625)	(3.652)	(2.275)	(2.000)	(2.412)	(3.690)
CLO tranche slicing	-0.005	-0.022	-0.015	0.006	0.003	-0.032
	(-0.181)	(-0.936)	(-0.631)	(0.217)	(0.119)	(-1.349)
Capital coverage test violation	-2.645***	-2.361***	-2.320***	-2.645***	-2.633***	-2.311***
	(-13.815)	(-15.382)	(-14.641)	(-13.607)	(-13.384)	(-14.322)
Interest coverage test violation	-0.666	-1.109***	-1.095***	-0.660	-0.691	-1.102***
	(-1.617)	(-4.468)	(-4.500)	(-1.566)	(-1.622)	(-4.366)
Risk test violation	-0.446***	-0.727***	-0.685***	-0.470***	-0.524***	-0.646***
	(-3.763)	(-7.553)	(-6.931)	(-4.079)	(-4.400)	(-6.771)
Income test violation	0.023	-0.170*	-0.185*	0.002	0.032	-0.142
	(0.171)	(-1.795)	(-1.909)	(0.015)	(0.244)	(-1.456)

TABLE 4 (Continued)

Originated post 2012	0.207	0.646***	0.720***	0.088	0.221	0.523***
	(0.755)	(3.158)	(3.369)	(0.307)	(0.793)	(2.584)
Days to maturity	0.651***	0.714***	0.758***	0.655***	0.674***	0.690***
	(5.826)	(8.423)	(8.836)	(5.927)	(5.962)	(8.144)
CLO size	-0.016	0.447***	0.409***	-0.027	-0.010	0.454***
	(-0.104)	(5.834)	(5.732)	(-0.170)	(-0.062)	(5.477)
Adj- R^2	42.55%	42.77%	42.34%	37.98%	40.62%	43.27%
Obs.	15,711	15,711	15,711	15,711	15,711	15,711

This table reports the results of the analyses on the relation between CLO test restrictiveness and CLO equity returns. All variables are defined in Appendix. The values of the continuous variables are winsorized at 1% and 99%. CLO reporting year, manager and arranger fixed effects are included but not tabulated. A constant is included but not tabulated. OLS regressions are used to estimate the models, with T-statistics reported in parentheses. Standard errors are corrected for heteroskedasticity and clustered at the CLO level. ***, ** and * denote significance at the 1%, 5% and 10% (two-sided) levels, respectively.

TABLE 5

CLO test restrictiveness and CLO note and equity prices

Variable	(I) *CLO note price*	(II) *CLO note price*	(III) *CLO equity price*	(IV) *CLO equity price*
CLO test restrictiveness	**0.075****		**-0.384****	
	(2.516)		**(-2.209)**	
Capital coverage restrictiveness		**0.077*****		**-0.358****
		(3.518)		**(-2.526)**
Interest coverage restrictiveness		**0.005**		**0.115**
		(0.290)		**(1.102)**
Risk restrictiveness		**0.022***		**-0.245*****
		(1.869)		**(-3.038)**
Income restrictiveness		**0.041****		**-0.036**
		(2.352)		**(-0.301)**
CLO tranche amount traded	0.003*	0.002	-0.024**	-0.020*
	(1.794)	(1.499)	(-2.165)	(-1.768)
Rating of CLO tranche traded	-0.005***	-0.005***		
	(-10.290)	(-9.681)		
CCC bucket	-0.010	-0.021	-0.387	-0.143
	(-0.215)	(-0.431)	(-1.091)	(-0.397)
Default bucket	0.057	0.037	-1.385**	-1.486**
	(1.339)	(0.759)	(-2.324)	(-2.042)
Weighted average note coupon	0.041***	0.030***	0.110***	0.139***
	(6.122)	(3.867)	(2.855)	(2.947)
Junior to senior note principal balance	-0.073**	-0.086**	-0.017	0.055
	(-2.127)	(-2.376)	(-0.074)	(0.236)
CLO tranche slicing	-0.000	-0.000	-0.007	-0.009*
	(-0.427)	(-0.121)	(-1.436)	(-1.875)
Capital coverage test violation	-0.049***	-0.043**	-0.020	-0.016
	(-2.891)	(-2.281)	(-0.272)	(-0.186)
Interest coverage test violation	-0.014	-0.013	-0.024	-0.026
	(-0.776)	(-0.693)	(-0.598)	(-0.595)
Risk test violation	0.014***	0.013***	-0.092***	-0.078***
	(3.264)	(2.862)	(-3.616)	(-2.896)
Income test violation	-0.005	-0.009	-0.061*	-0.059*
	(-0.942)	(-1.619)	(-1.761)	(-1.684)
Originated post 2012	-0.048***	-0.050***	-0.099**	-0.139***
	(-5.155)	(-5.119)	(-2.005)	(-2.808)

TABLE 5 (Continued)

Days to maturity	-0.031***	-0.031***	0.119***	0.121***
	(-7.181)	(-7.008)	(5.473)	(5.406)
CLO size	-0.013***	-0.015***	0.112***	0.119***
	(-3.187)	(-3.563)	(4.198)	(4.516)
Adj- R2	61.68%	62.23%	49.56%	49.87%
Obs.	6,573	6,573	854	854

This table reports the results of the analyses on the relation between CLO test restrictiveness and prices of CLO note tranche trades and CLO equity tranche trades. All variables are defined in Appendix. The values of the continuous variables are winsorized at 1% and 99%. CLO reporting year, CLO tranche seniority (in columns I and II), manager and arranger fixed effects are included but not tabulated. A constant is included but not tabulated. OLS regressions are used to estimate the models, with T-statistics reported in parentheses. Standard errors are corrected for heteroskedasticity and clustered at the CLO level. ***, ** and * denote significance at the 1%, 5% and 10% (two-sided) levels, respectively.

TABLE 6

CLO test restrictiveness and trading activities

Variable	(I) *Portfolio turnover*	(II) *High trading volume*	(III) *Avg. loan holding period*	(IV) *Avg. holding period of loans with (price decrease -price increase)*	(V) *Loan returns/profits*	(VI) *Credit risk of loan sales -credit risk of loan purchases*
CLO test restrictiveness	**0.046*** **	**0.353*** **	**-0.832** **	**1.646** **	**-0.675*** **	**-1.757** **
	(3.065)	**(2.947)**	**(-2.127)**	**(2.333)**	**(-2.630)**	**(-2.037)**
CCC bucket	0.125***	-0.161	0.280	2.141**	0.268	0.120
	(4.280)	(-1.058)	(0.455)	(1.994)	(0.646)	(0.113)
Default bucket	-0.090***	-0.042	-0.038	0.342	0.571**	-1.461*
	(-5.128)	(-0.703)	(-0.150)	(0.600)	(2.295)	(-1.807)
CLO tranche rating	0.003***	-0.001	0.014	-0.020	-0.005	0.033
	(6.334)	(-0.336)	(1.204)	(-0.944)	(-0.599)	(1.420)
Weighted average note coupon	-0.003	-0.010	-0.704***	0.297***	-0.041	0.107*
	(-0.768)	(-0.747)	(-7.692)	(4.407)	(-1.416)	(1.819)
Junior to senior note principal balance	0.004	0.025	1.439***	-0.369**	0.021	0.010
	(0.247)	(1.308)	(3.140)	(-2.076)	(0.075)	(0.012)
CLO tranche slicing	0.001***	0.013***	0.026**	0.067***	-0.005	0.000
	(3.352)	(3.504)	(2.508)	(3.404)	(-0.758)	(0.008)
Capital coverage test violation	-0.001	-0.075***	-0.363***	-0.158	-0.045	0.133
	(-0.347)	(-3.319)	(-3.105)	(-0.930)	(-0.543)	(0.843)
Interest coverage test violation	-0.039***	0.003	0.049	-0.330	0.321**	0.156
	(-3.695)	(0.120)	(0.341)	(-1.043)	(2.022)	(0.586)
Risk test violation	-0.034***	-0.055***	-0.113**	-0.296***	0.101***	0.210**
	(-11.996)	(-3.806)	(-2.303)	(-3.314)	(2.782)	(2.309)
Income test violation	-0.015***	-0.036*	0.209***	-0.117	0.134***	-0.165
	(-3.085)	(-1.823)	(3.907)	(-1.132)	(2.618)	(-1.201)

TABLE 6 (Continued)

Originated post 2012	0.048***	0.306***	-0.864***	0.525***	-0.171***	0.466***
	(8.372)	(9.670)	(-6.499)	(4.014)	(-2.586)	(3.420)
Days to maturity	0.021***	-0.041***	-0.239***	0.477***	-0.247***	-0.306**
	(9.241)	(-3.521)	(-2.686)	(3.259)	(-5.052)	(-1.989)
CLO size	0.007***	0.094***	0.086**	0.130	0.072**	0.347***
	(3.106)	(5.300)	(2.018)	(1.142)	(1.968)	(3.351)
Adj- R^2	20.24%	26.62%	35.47%	19.36%	16.27%	24.49%
Obs.	15,711	15,711	11,458	11,458	11,458	12,152

This table reports the results of the analyses on the relation between CLO test restrictiveness and CLO manager's trading activities. All variables are defined in Appendix. The values of the continuous variables are winsorized at 1% and 99%. CLO reporting year, manager and arranger fixed effects are included but not tabulated. A constant is included but not tabulated. OLS regressions are used to estimate the models, with T-statistics reported in parentheses. Standard errors are corrected for heteroskedasticity and clustered at the CLO level. ***, ** and * denote significance at the 1%, 5% and 10% (two-sided) levels, respectively.

TABLE 7

CLO test restrictiveness, trading activities and equity returns

Panel A: The effect of trading activities on annualized distributions to equity-holders by CLO with restrictive tests.

	Equity returns 1					
Variable	(I)	(II)	(III)	(IV)	(V)	(VI)
CLO test restrictiveness	-8.453***					
	(-2.758)					
Portfolio turnover	**13.635*** **					
	(11.081)					
CLO test restrictiveness x Portfolio turnover	**-8.792*** **					
	(-3.543)					
CLO test restrictiveness		-8.934***				
		(-2.950)				
High trading volume		**2.190*** **				
		(9.428)				
CLO test restrictiveness x High trading volume		**-9.774*** **				
		(-3.003)				
CLO test restrictiveness			-7.334**			
			(-2.168)			
Avg. loan holding period			**-0.038**			
			(-0.368)			
CLO test restrictiveness x Avg. loan holding period			**-5.593** **			
			(-2.034)			
CLO test restrictiveness				-9.582***		
				(-2.833)		
Holding period of loans with (price decrease -price increase)				0.223***		
				(4.100)		
CLO test restrictiveness x Holding period of loans with (price decrease -price increase)				1.826		
				(1.330)		
CLO test restrictiveness					-11.489***	
					(-3.510)	
Loan returns/profits					**0.290*** **	
					(2.870)	
CLO test restrictiveness x Loan returns/profits					**-6.019*** **	
					(-3.211)	

TABLE 7 (Continued)

CLO test restrictiveness						-5.977*
						(-1.936)
Credit risk of loan sales -credit risk of loan purchases						**0.083*** **
						(4.962)
CLO test restrictiveness x Credit risk of loan sales -credit risk of loan purchases						**-2.277*** **
						(-4.436)
Controls	YES	YES	YES	YES	YES	YES
Adj- R^2	45.53%	45.30%	35.47%	46.53%	42.19%	48.93%
Obs.	15,711	15,711	11,458	11,458	11,458	12,152

Panel B: The effect of trading activities on quarterly distributions to equity-holders by CLO with restrictive tests.

			Equity returns 2			
Variable	(I)	(II)	(III)	(IV)	(V)	(VI)
CLO test restrictiveness	-2.605***					
	(-3.373)					
Portfolio turnover	**3.207*** **					
	(9.968)					
CLO test restrictiveness x Portfolio turnover	**-3.689*** **					
	(-3.606)					
CLO test restrictiveness		-2.770***				
		(-3.634)				
High trading volume		**0.532*** **				
		(8.866)				
CLO test restrictiveness x High trading volume		**-2.085** **				
		(-2.480)				
CLO test restrictiveness			-1.988**			
			(-2.246)			
Avg. loan holding period			**-0.024**			
			(-0.830)			
CLO test restrictiveness x Avg. loan holding period			**-1.332***			
			(-1.798)			
CLO test restrictiveness				-2.837***		
				(-3.242)		
Holding period of loans with (price decrease -price increase)				**0.050*** **		
				(3.587)		

TABLE 7 (Continued)

CLO test restrictiveness x Holding period of loans with (price decrease -price increase)				**0.308**		
				(0.879)		
CLO test restrictiveness					-0.027***	
					(-3.057)	
Loan returns/profits					**0.001*** **	
					(3.505)	
CLO test restrictiveness x Loan returns/profits					**-0.016*** **	
					(-3.093)	
CLO test restrictiveness						-1.968**
						(-2.538)
Credit risk of loan sales -credit risk of loan purchases						**0.023*** **
						(5.335)
CLO test restrictiveness x Credit risk of loan sales -credit risk of loan purchases						**-0.559*** **
						(-4.357)
Controls	YES	YES	YES	YES	YES	YES
Adj- R^2	45.53%	45.30%	35.47%	46.53%	42.19%	48.93%
Obs.	15,711	15,711	11,458	11,458	11,458	12,152

This table reports the results of the analyses on the relation between CLO trading activities and CLO annualized equity distributions (Panel A) and quarterly equity distributions (Panel B) on a cash-flow basis by CLOs with restrictive tests. All variables are defined in Appendix. The values of the continuous variables are winsorized at 1% and 99%. CLO reporting year, manager and arranger fixed effects are included but not tabulated. A constant is included but not tabulated. OLS regressions are used to estimate the models, with T-statistics reported in parentheses. Standard errors are corrected for heteroskedasticity and clustered at the CLO level. ***, ** and * denote significance at the 1%, 5% and 10% (two-sided) levels, respectively.

TABLE 8

CLO test restrictiveness and likelihood of test violation

	(I)	(II)	(III)	(IV)	(V)
Variable	*CLO test slack*	*Probability of 5% CLO test slack*	*Default bucket*	*CCC bucket*	*CLO tranche rating downgrade*
CLO test restrictiveness	**0.006**	**0.129**	**0.046**	**-0.023**	**-0.029**
	(0.575)	**(0.973)**	**(1.493)**	**(-1.416)**	**(-0.537)**
Controls	YES	YES	YES	YES	YES
Adj- R^2	68.27%	19.72%	33.66%	46.05%	48.17%
Obs.	15,711	15,711	15,711	15,711	15,711

This table reports the results of the analyses on the relation between CLO test restrictiveness and CLO performance. *CLO test slack* is the average standardized slack across CLO tests (capital coverage, interest coverage, income and risk). CLO test slack is the percentage difference between the CLO test score minus the CLO test threshold (CLO test threshold minus the CLO test score for the risk test). The CLO test slack is then standardized based on the distribution of this variable. *Probability of 5% CLO test slack* is an indicator variable of whether the slack of a CLO test is between 0% and 5%, and zero otherwise. *CLO tranche rating downgrade* is an indicator variable of whether a CLO tranche has been downgraded by at least one notch since previous quarter, and zero otherwise. All other variables are defined in the Appendix. The values of the continuous variables are winsorized at 1% and 99%. In columns I and II, the CLO test violation variables are excluded from the control variables. In column III (IV), the variable *Default bucket* (*CCC bucket*) is excluded from the control variables. All model specifications and the other control variables (untabulated) are the same as in Model 2. CLO reporting year, manager and arranger fixed effects are included but not tabulated. A constant is included but not tabulated. OLS regressions are used to estimate the models, with T-statistics reported in parentheses. Standard errors are corrected for heteroskedasticity and clustered at the CLO level. ***, ** and * denote significance at the 1%, 5% and 10% (two-sided) levels, respectively.

TABLE 9

Alternative measure for CLO test restrictiveness and CLO equity returns

Variable	(I) *Equity returns 1*	(II) *Equity returns 2*
Lax CLO test restrictions upon origination	**1.489*** **	**0.003** **
	(3.018)	**(2.126)**
CCC bucket	3.792	0.013
	(0.617)	(0.792)
Default bucket	-9.431***	-0.024***
	(-4.037)	(-3.615)
CLO tranche rating	0.281***	0.001***
	(3.058)	(3.188)
Weighted average note coupon	1.246***	0.003***
	(3.292)	(3.016)
Junior to senior note principal balance	3.523	0.002
	(0.927)	(0.217)
CLO tranche slicing	0.000	-0.000
	(0.002)	(-0.735)
Capital coverage test violation	-2.008	-0.007
	(-0.984)	(-1.521)
Interest coverage test violation	1.775	0.005
	(1.159)	(1.295)
Risk test violation	-0.690*	-0.002**
	(-1.967)	(-2.398)
Income test violation	0.156	-0.000
	(0.460)	(-0.306)
Originated post 2012	2.224	0.008**
	(1.501)	(1.992)
Days to maturity	0.313	0.002
	(0.557)	(1.552)
CLO size	-0.190	-0.004**
	(-0.244)	(-2.055)
Adj- R^2	51.31%	36.78%
Obs.	2,602	2,602

This table reports the results of the analyses on the relation between CLO test restrictiveness and CLO equity returns using an alternative measure for CLO test restrictiveness. We measure CLO test restrictiveness by how close a test threshold is set relative to the level of test score at the inception of the CLO. Focusing on CLOs originated post 2009, we measure the initial slack of the capital coverage, interest coverage, risk and income test by [(test score up to one quarter post CLO origination- test threshold)/ test threshold]. We average initial slack across all tests. *Lax CLO test restrictions upon origination* is an indicator of whether a CLO's initial average test slack is ranked in the upper quintile of the distribution, and zero otherwise. This restrictive sample includes 311 unique CLOs. All other variables are defined in Appendix. The values of the continuous variables are winsorized at 1% and 99%. CLO reporting year, manager and

arranger fixed effects are included but not tabulated. A constant is included but not tabulated. OLS regressions are used to estimate the models, with T-statistics reported in parentheses. Standard errors are corrected for heteroskedasticity and clustered at the CLO level. $***$, $**$ and $*$ denote significance at the 1%, 5% and 10% (two-sided) levels, respectively.