

Covenant-Driven Fire Sales*

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Abstract

Covenants mitigate agency frictions but can trigger asset sales at fire sale prices. I demonstrate covenant-driven fire sales and trace their real effects. Following a large negative oil-price shock, collateralized loan obligations exposed to oil-and-gas (O&G) firms approach their covenant thresholds and sell non-O&G loans, exerting price-pressure on non-O&G bonds and loans in primary and secondary markets. Affected non-O&G borrowers experience declines in financing, investment, R&D, and employment. Instrumenting CLO net loan sales with lenders' O&G exposure, a one-percentage-point increase reduces firm investment by 0.08 percentage-points, 5% of mean investment. Covenant-induced liquidations can thus generate credit crunches via capital-market contagion.

JEL codes: E44, G23, G32

Keywords: covenants, fire sales, contracting frictions, closed-end funds, CLOs

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1 Introduction

Covenants help resolve incomplete contracting issues by aligning incentives (e.g., [Rajan and Winton, 1995](#)), allocating control rights ([Aghion and Bolton, 1992](#)), and preventing risk-shifting ([Jensen and Meckling, 1976](#)). In this paper, I show that while covenants can be beneficial in the partial equilibrium of firm-level contracting, they can have negative consequences in general equilibrium. Specifically, covenants can trigger and amplify fire sales, which, in turn, induce adverse effects on the real economy. After illustrating how covenants can trigger fire sales, I uncover a novel mechanism of capital-market contagion that can amplify financial stress and lead to broader economic instability. My findings show that fire sales can arise even when contracts include a richer set of state-contingent features through covenants. This contrasts with traditional models, which attribute fire sales to the limited state-contingency or incompleteness of financial contracts. Understanding this mechanism is important for designing financial contracts that account for their unintended consequences (e.g., [Lorenzoni, 2008](#); [Dávila and Korinek, 2018](#); [Kurlat, 2021](#); [Eisenbach and Phelan, 2022](#)).

I focus on covenant-driven fire sales in collateralized loan obligations (CLOs). CLOs provide an ideal setting because CLO managers operate within a structured contracting framework where covenants impose strict constraints on portfolio composition. However, identifying the causal impact of covenant-driven liquidations poses a key challenge, as it requires a plausibly exogenous shock that tightens covenants and forces asset sales. I address this challenge by exploiting variation in CLO exposure to the oil and gas (O&G) industry and a large negative oil-price shock.

To fix ideas, consider a CLO with substantial exposure to O&G loans. When oil prices fall, the CLO's covenants tighten, incentivizing it to liquidate loans to comply with the covenant thresholds. Importantly, I find that these liquidations extend beyond the distressed O&G loans to firms *unrelated* to the shock, i.e., to “innocent bystanders.”¹ As their loans are liquidated, these firms experience fire-sale discounts in both secondary and primary markets, affecting not only loans but also bonds, and resulting in higher borrowing costs. This, in turn, constrains borrowers' ability to raise debt, sustain cash flow, invest in R&D, pursue acquisitions, and expand employment.

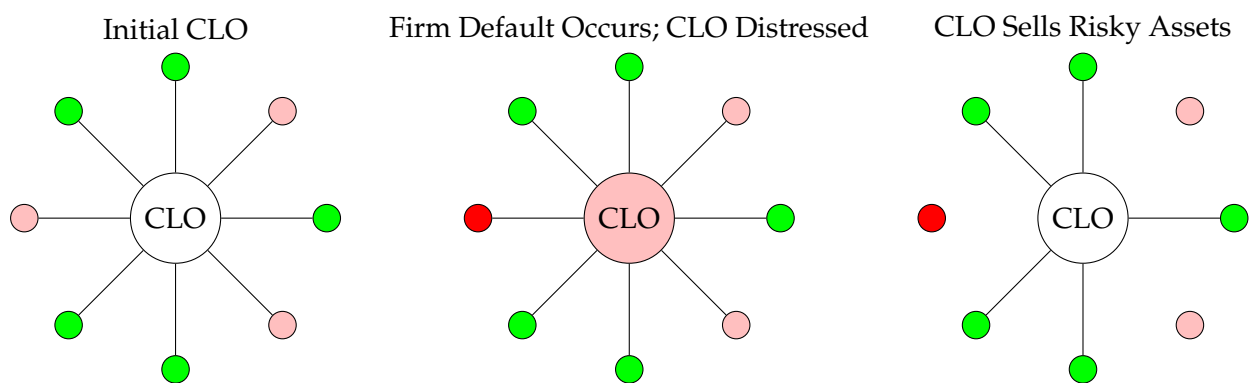
This mechanism of capital-market contagion implies that covenants intended to mitigate risk at the individual CLO level can instead propagate financial stress across markets, with consequences for the real economy. A growing macro-finance literature shows that the form of borrowing constraints shapes how financial frictions transmit through the economy (e.g., [Caglio, Darst and Kalemli-Özcan, 2021](#); [Lian and Ma, 2021](#); [Drechsel, 2023](#); [Greenwald, 2019](#)). These papers document settings where credit capacity is tied to earnings, collateral values, or financial covenants linked to firm performance, such that aggregate shocks mechanically tighten borrowing limits by reducing the affected firms' cash flows or collateral values.

¹These “innocent bystander” firms have no direct exposure to oil and gas; they are affected solely because their loans are held by CLOs facing covenant pressure from an unrelated sector. Because CLO accounting rules penalize distressed loans most heavily, spillovers concentrate among non-O&G borrowers whose loans are already discounted or lower-rated – precisely the credits that impose the largest par haircuts.

My findings reveal a distinct channel: intermediary-level constraints that transmit shocks through secondary-market dislocations. When sectoral shocks impair CLO portfolio quality, covenant-driven asset sales generate price pressure and tighter financing conditions for “innocent bystander” firms whose own fundamentals remain stable. Credit tightens not because these firms’ performance has deteriorated, but because their loans are held by constrained intermediaries exposed to an unrelated sector.

To elaborate, first, I outline the mechanism through which firm distress spills over to other firms via CLO contracts. Then, I describe my empirical strategy for identifying and measuring these effects.

Covenant-Driven Sales



Notes: The diagram shows three CLO portfolio scenarios. A center circle represents a CLO, outer circles represent firms, and spokes indicate connections. The left figure shows a healthy portfolio, the middle figure shows a distressed firm (red) constraining the CLO (pink), and the right figure shows the CLO alleviating constraints by divesting the distressed firm and selling risky loans (pink).

This covenant-driven liquidation mechanism is illustrated above. In the initial state (left), the CLO holds a diversified portfolio and maintains ample distance from its par-based covenant thresholds. When a borrower experiences distress or default (center), the affected loan is marked down from par to a lower accounting value, tightening the CLO’s par coverage and reducing its buffer relative to covenant limits. These covenants are designed to ensure sufficient collateralization by requiring asset values to remain well above liabilities. As covenant slack diminishes, the risk of breaching these thresholds rises, which can divert cash flows away from junior tranches and manager fees, generate reputational costs, and trigger other contractual penalties.

To avoid a breach and restore covenant compliance, CLO managers respond by liquidating loans that impose the largest par haircuts, typically risky or distressed assets whose market values exceed their accounting values. While this improves par-based ratios, it often requires selling loans unrelated to the initial default (right). Because covenant constraints apply at the portfolio level, distress originating from a single borrower can propagate to other firms held by the same CLO, transmitting liquidation pressure across otherwise unrelated borrowers. I exploit a natural experiment to identify this amplification channel and disentangle covenant-driven liquidations from alternative explanations.

In particular, I employ a reduced-form instrumental variables strategy to identify covenant-driven fire sales. I compare outcomes for non-O&G firms between 2013 and 2015, before and after the June 2014 oil price collapse, across U.S. CLOs with differing exposures to O&G loans. The oil price collapse of more than 70%, from over \$100 per barrel in June 2014 to under \$30 by early 2016, constituted one of the largest sector-specific shocks to the U.S. CLO market. I argue that the O&G price plunge is exogenous and that the matching of firms to CLOs is as good as random, as supported by a battery of tests.²

I delineate the causal pathway connecting covenant tightening to fluctuations in asset prices and firm operations, using detailed microdata on CLO portfolios and firm outcomes. First, I show that a CLO's exposure to the O&G industry directly affects the tightness of its covenants. Following the O&G price collapse, CLOs with greater ex-ante exposure to O&G loans face significantly tighter covenants compared to those with lower exposure. Specifically, a one percentage point increase in a CLO's O&G loan share is associated with a 0.2–0.3% reduction in its distance to the most binding par-based covenant following the shock. This effect is substantial: while the median CLO has historically maintained a 3.37 percent buffer from its most stringent covenant threshold since the Great Recession, many operate with much narrower margins. During the O&G price plunge, the average CLO breached its most stringent covenant threshold.

Second, I show that firms held by CLOs with tighter covenants experience greater loan liquidations and price distortions in secondary markets. To measure a firm's exposure to the oil-price shock, I calculate the weighted average O&G exposure across all CLOs holding the firm's debt. Firms whose loans are held by CLOs with higher O&G exposure experience substantially larger loan liquidations following the shock. Specifically, a one percentage point increase in a firm's O&G exposure through CLOs is associated with transaction volume declines of up to 60% and secondary loan price declines of \$0.98 to \$2.70 per \$100 of par value.

Third, I establish that covenant constraints, rather than general risk aversion or market conditions, drive these spillovers. The key mechanism operates through "contractual arbitrage": CLO managers sell loans whose market prices exceed their recorded accounting values to improve covenant ratios. Although loans generally trade below book value, accounting rules impose specific treatments for riskier assets: defaulted loans are marked between market and expected recovery value; discounted loans are carried at purchase price until sustained price recovery; and when CCC-rated (or lower) holdings exceed 7.5% of a CLO

²A common concern is that firm distress within a portfolio may reflect correlated, unobserved characteristics of the fund rather than causal spillovers. Exploiting variation in oil price movements substantially mitigates these concerns by limiting the scope for endogenous matching between CLOs and portfolio firms. This claim is supported by several pieces of statistical evidence. I conduct cross-sectional regressions, compare Herfindahl–Hirschman indices, and perform Kolmogorov–Smirnov tests, all of which indicate that CLOs with high and low exposure to oil and gas (O&G) firms are similar across a broad set of observable characteristics. Selection concerns are further attenuated in this setting as CLOs hold largely overlapping portfolios, exhibit no systematic relationship between pre-shock O&G exposure and covenant thresholds, and show no evidence of hedging O&G risk through portfolio allocation. Because the O&G price collapse was largely unforeseen, cross-CLO variation in O&G exposure can be plausibly treated as exogenous, supporting its use as a valid instrument for identifying the amplification mechanism.

portfolio, the excess is marked to market starting with the lowest-priced loans.³ Consequently, by liquidating higher-priced distressed loans, managers both realize market values and exploit the discontinuous accounting treatment embedded in covenant calculations, mechanically increasing par-based covenant ratios. This piecewise covenant design across the loan-quality spectrum creates contracting frictions that give rise to contractual arbitrage.⁴

To isolate this covenant mechanism from alternative explanations, I employ several complementary identification strategies. Firm-level instrumental variables formalize the causal chain, showing that exogenous increases in fire sale intensity directly raise financing costs and propagate balance-sheet stress to borrower outcomes. Quantitatively, the IV estimates imply that a one-percentage-point increase in CLO net loan sales reduces non-O&G firm investment by 0.08 percentage points per quarter, approximately 5% of mean quarterly investment, yielding a directly interpretable causal magnitude that complements the reduced-form patterns reported throughout the paper. Heterogeneity by covenant distance shows that effects concentrate among CLOs operating closest to their covenant thresholds, where covenant pressure is most binding. Threshold-based exposure measures exploiting the 7.5% CCC limit show that effects are larger for firms whose CLO lenders exceed this contractual cutoff. Effects also scale monotonically with firm dependence on CLO financing, reaching their largest magnitude for firms most reliant on this funding source. Finally, falsification tests on loan types exempt from CLO covenants yield null results, ruling out demand-side explanations. Together, these strategies demonstrate that contractual features create binding constraints that force portfolio liquidations even when managers would prefer to avoid sales.

Fourth, covenant-driven liquidations generate spillovers that extend beyond secondary loan markets to primary loan issuance and corporate bond markets. A one percentage point increase in firm O&G exposure through CLOs is associated with secondary loan price declines of 98 to 270 basis points per hundred dollars of par value, primary loan spread increases of up to 20 basis points, and credit spread widening of up to 33 basis points in bond markets. These cross-market effects reveal limits to arbitrage that prevent other market participants from frictionlessly absorbing CLO sales.⁵ Price impacts in leveraged loan markets substantially exceed those in more liquid debt markets, highlighting the role of market liquidity in amplifying these effects.

These financial market dislocations persist long enough to generate significant real economic effects. I trace the full chain from the O&G price plunge through fire sales to real economic activity. As the effective cost of capital rises for innocent bystanders, firms have limited ability to substitute to other financing sources. Firms whose loans are held by CLOs with greater O&G exposure draw down credit lines more aggressively compared

³Several reports and prospectuses document these rules, including [Hu and Saykovskiy \(2019\)](#), [CreditFlux \(2020\)](#), [Scaggs \(2020\)](#), [Cioffi \(2020\)](#), [GSO Capital Partners \(2020\)](#), and [Fleckenstein \(2022\)](#).

⁴This mechanism is akin to [Kojen and Yogo \(2015\)](#) which shows that insurers sold policies below actuarial fair value during the 2007-2009 crisis to alleviate financial constraints.

⁵See [Shleifer and Vishny \(1992\)](#), [Shleifer and Vishny \(1997\)](#), [Gromb and Vayanos \(2002\)](#), [Gabaix, Krishnamurthy and Vigneron \(2007\)](#), [Gromb and Vayanos \(2010\)](#), [Chernenko and Sunderam \(2012\)](#), and [Gromb and Vayanos \(2018\)](#) for theory and evidence on segmented markets and limits to arbitrage.

to firms with lower exposure. However, this liquidity proves insufficient to preserve real activity. Exposed firms make financial and operational adjustments following a pecking order: innovation and organizational adjustments (R&D and employment) are most affected, followed by financing constraints (debt growth), operating performance (sales growth), and strategic activity (investments and acquisitions).

Importantly, fire sale externalities concentrate sharply among financially constrained borrowers, those without bond market access, facing near-term debt maturities, or unable to refinance early during the shock. For these vulnerable firms, effects are two to twelve times larger than for unconstrained firms across all outcomes. Investment declines reach 2.45 percentage points for constrained firms compared to negligible effects for those with alternative financing. This concentration indicates that covenant-driven fire sales impose their greatest costs precisely on borrowers least able to substitute away from CLO financing. Similarly, loan sales disproportionately affect riskier firms whose loans exhibit higher market values relative to recorded values. Following the shock, CLOs systematically shed distressed holdings while retaining higher-quality positions, rationalizing why declines in debt prices and economic activity concentrate among covenant-sensitive borrowers.

Although the empirical design identifies relative effects across firms rather than a structural decomposition of aggregate dynamics, the estimated magnitudes indicate that covenant-driven fire sales are economically meaningful at the market level. Cross-sectional variation in exposure to CLO covenant pressure is large relative to observed aggregate movements during the episode: in investment, the dispersion implied by differences in CLO exposure is comparable in magnitude to the overall decline in average investment among non-O&G firms, pointing to substantial reallocation of real activity across borrowers rather than a uniform contraction. In leveraged loan markets, spread increases for firms with moderate to high exposure far exceed the modest rise in average market-wide yields, revealing pronounced heterogeneity in financing conditions beneath relatively muted aggregate trends. Real-side effects extend beyond investment to employment, R&D, and debt growth, and concentrate among financially constrained borrowers with limited access to alternative financing. Taken together, these patterns show that covenant-driven fire sales constitute a quantitatively important transmission mechanism that reallocates credit and real activity across firms and amplifies sectoral shocks into broader economic effects, particularly for borrowers with limited access to alternative financing.

The baseline analysis focuses on the 2014 oil-price collapse, a relatively benign macroeconomic period characterized by calm and liquid financial markets. This setting is useful because it isolates covenant pressure as the primary source of cross-firm spillovers, minimizing confounding forces from broad-based financial distress. To assess external validity, I examine the same mechanism during the COVID-19 pandemic, when the O&G price shock was substantially more severe. During this period, covenant-driven effects amplify by up to a factor of four, consistent with fire sales operating alongside tighter market-wide funding conditions and more limited arbitrage capacity.

Overall, these findings suggest that closed-end fund structures like CLOs are not a

panacea for fire-sale pressures as covenants necessary to support their long-term funding structure can still lead to fire sales. These results raise questions about the optimal design of financial contracts. One perspective argues that the observed fire-sale effects reflect issues in CLO contracts and addressing this “bug” may remove the perverse effects of covenants. However, an alternative perspective suggests that fire sales are not a bug but rather a feature as the current covenants may be necessary to support the long-term funding structure of CLOs and improve stability relative to short-term funding, even if liquidity challenges persist. Regardless of which perspective is correct, a key implication of my results is that contractual covenants faced by financial intermediaries should not be viewed solely in partial equilibrium, as they can have broader general equilibrium effects through capital markets.

1.1 Related Literature

Traditional models attribute fire sales to limited state-contingency or incompleteness of financial contracts. For example, in banking, demand deposits create fire-sale dynamics by offering immediate liquidity to depositors facing shocks (e.g., [Diamond and Dybvig, 1983](#); [Allen and Gale, 1998](#)). Similarly, in macro-finance, binding net worth constraints force distressed firms to liquidate assets at depressed prices (e.g., [Bernanke and Gertler, 1989](#); [Kiyotaki and Moore, 1997](#)). However, I show that fire sales can also arise *because* of state contingency, through contracts incorporating richer state-contingent features via covenants. Covenants are designed primarily to mitigate “partial equilibrium” agency conflicts between creditors and asset managers but can inadvertently generate externalities through sales. This finding suggests that liquidation pressures may be endemic to financial intermediation, irrespective of whether institutions operate with closed-end or open-end structures.⁶

A related but distinct strand of literature emphasizes procyclicality arising from borrower-side constraints rather than from intermediary balance-sheet stress. [Lian and Ma \(2021\)](#) establish that cash flow–based debt dominates asset-based lending for U.S. corporations, with 80% of debt tied to earnings rather than collateral liquidation values. Recent work demonstrates multiple channels through which performance-linked borrowing limits amplify fluctuations. [Drechsel \(2023\)](#) shows that earnings-based covenants mechanically tighten when profitability declines, amplifying investment responses to shocks. [Caglio, Darst and Kalemli-Özcan \(2021\)](#) document that for small and medium enterprises relying on accounts receivable and inventory as collateral, monetary policy affects borrowing capacity through changes in sales and working capital values. [Greenwald \(2019\)](#) shows that interest coverage covenants, which cap interest payments relative to earnings, create state-dependent monetary transmission, with credit constraints relaxing mechanically when interest rates

⁶In the absence of state-contingent provisions, agency problems arise in closed-end funds, manifesting as the “closed-end fund puzzle” where shares trade at discounts to net asset value (e.g., [Barclay, Holderness and Pontiff, 1993](#); [Malkiel, 1977](#); [Chay and Trzcinka, 1999](#); [Bradley et al., 2010](#); [Wang and Nanda, 2011](#)). Open-end funds address agency problems by allowing investor withdrawals, which [Fama and Jensen \(1983\)](#) describes as “a form of partial takeover or liquidation which deprives management of control over assets.” However, redeemable claims also render open-end funds vulnerable to fire sales (e.g., [Coval and Stafford, 2007](#); [Greenwood and Thesmar, 2011](#); [Jotikasthira, Lundblad and Ramadorai, 2012](#); [Hau and Lai, 2013](#); [Merrill et al., 2012](#)). See [Shleifer and Vishny \(2011\)](#) for a survey.

fall. The common mechanism is that credit conditions worsen because the borrower's own fundamentals deteriorate, directly constraining access to credit.

While these mechanisms also generate procyclical credit outcomes, they differ fundamentally from the channel studied here. First, in borrower-side covenant settings, credit constraints tighten because the borrower's own performance deteriorates in response to aggregate shocks. In [Caglio, Darst and Kalemli-Özcan \(2021\)](#), monetary policy affects borrowing capacity through changes in firm earnings and the resulting value of working capital collateral for *that specific firm*. In contrast, the mechanism I document affects firms whose earnings, receivables, and collateral are unchanged; credit tightens because their intermediary faces constraints from an unrelated sector. Second, the type of covenant differs. Borrower financial covenants tie credit capacity to the borrower's own metrics, mechanically tightening when performance deteriorates. CLO portfolio covenants trigger cash flow diversion and create incentives for asset sales when *aggregate portfolio quality* deteriorates, regardless of any individual borrower's fundamentals. Third, the transmission channel differs. Borrower-side constraints operate through reduced borrowing capacity for affected firms. Intermediary-side constraints operate through secondary market dislocations that raise borrowing costs for all firms whose debt is held by constrained intermediaries, regardless of their own creditworthiness.

Identifying this intermediary-side covenant channel empirically requires a setting in which asset sales are not mechanically driven by investor withdrawals or borrower-level distress, and where contractual constraints are both observable and binding. CLOs provide such a setting. CLOs operate under a closed-end structure that largely insulates them from investor-driven redemptions, while simultaneously imposing portfolio-level covenants that govern asset composition and leverage. This combination makes CLOs a natural laboratory for isolating covenant-driven fire sales from more familiar liquidity- or net-worth-based mechanisms.

At the same time, CLOs are not immune to other forms of intermediary stress, and existing channels may still contribute to asset sales. Prior studies, including [Elkamhi and Nozawa \(2022\)](#) and [Kundu \(2024\)](#), document that CLOs preemptively sell distressed loans, generating price pressure on these assets—consistent with a standard net worth channel in which intermediaries liquidate troubled positions to preserve capital and limit further losses.⁷

This paper moves beyond the net worth channel by identifying a distinct mechanism, covenant-driven fire sales, that operates through spillovers rather than direct firm distress. Unlike net worth-driven selling, which predicts liquidation of assets most exposed to losses, covenant-driven sales are dictated by contractual thresholds and accounting rules, compelling CLOs to liquidate specific holdings even when borrower fundamentals are unchanged. As a result, liquidation pressure spills over to otherwise unaffected borrowers, generating price distortions and tighter financing conditions that cannot be explained by borrower risk or intermediary capital preservation alone. Thus, this study sheds light on the specific role of

⁷For example, if an O&G firm defaults, constrained CLOs may sell loans issued by the same firm, further depressing their prices.

covenants in generating and amplifying fire sales and their consequences for real economic activity among innocent bystanders, building upon a growing literature examining financial and real consequences of covenant violations (e.g., [Chava and Roberts, 2008a](#); [Roberts and Sufi, 2009a,b](#); [Nini, Smith and Sufi, 2012](#); [Murfin, 2012](#); [Acharya, Almeida and Campello, 2013](#); [Acharya et al., 2020](#); [Chodorow-Reich and Falato, 2022](#)).

Importantly, I show that market financing, in contrast to relationship financing like bank lending, can affect firms' financial decisions and real economic activity due to contracting frictions. Previous papers on credit supply shocks focus on bank lending relationships' role in firm outcomes (e.g., [Bernanke and Blinder, 1988](#); [Bernanke and Gertler, 1989](#); [Holmstrom and Tirole, 1997](#); [Peek and Rosengren, 2000](#); [Khwaja and Mian, 2008](#)).⁸ These papers are consistent with the view that firms operating in informationally sensitive environments cannot readily substitute to other financing sources. For example, [Iyer et al. \(2014\)](#) show that credit supply reduction is strongest for smaller firms that cannot compensate for credit crunches with other debt sources. By contrast, this paper emphasizes the role of financing frictions in a market-based setting, featuring larger firms. I show that contracting frictions in CLO markets can propagate to firms unable to substitute to other financing sources, even when other markets are not dislocated. Hence, shocks to CLOs, a market-based financing mechanism, can transmit to firms and have real effects.

The remainder of the paper is organized as follows. Section 2 describes the institutional setting and the scope for contractual arbitrage. Section 3 presents the data. Section 4 outlines the empirical methodology. Section 5 reports the main empirical findings, while Section 6 examines the underlying mechanism. Section 7 presents robustness analyses, and Section 8 provides back-of-the-envelope calculations. Section 9 concludes.

2 Institutional Background and Contractual Arbitrage

While covenants support the long-term funding structure of CLOs, they can create fire sale risk. This section first describes the mechanics of CLOs and their covenants. It then shows that CLOs can maximize improvements to their covenants by selling loans that exhibit higher market values than recorded values. This practice of "contractual arbitrage" can generate fire sales in the leveraged loan market.

A CLO operates as a special purpose vehicle (SPV) that issues tranching asset-backed securities or notes, and uses the proceeds to finance the purchase of an underlying portfolio of leveraged loans. CLOs have covenants to align managerial incentives with those of their debt investors.⁹ I focus on the par-based covenants as CLOs operate closest to these covenants

⁸Banks are known to be more efficient at resolving informational asymmetries than markets. See [Kashyap, Lamont and Stein \(1994\)](#), [Gertler and Gilchrist \(1994\)](#), [Kashyap and Stein \(2000\)](#), [Paravisini \(2008\)](#), [Ivashina and Scharfstein \(2010\)](#), [Chava and Purnanandam \(2011\)](#), [Benmelech, Bergman and Seru \(2021\)](#), [Schnabl \(2012\)](#), [Chodorow-Reich \(2014\)](#), [Huber \(2018\)](#), [Amiti and Weinstein \(2018\)](#), [Kundu and Vats \(2021\)](#), and [Kundu, Park and Vats \(2023\)](#) for evidence on credit supply shock propagation.

⁹A CLO manager's incentives are most aligned with the equity class as their compensation consists of a fixed fee and series of subordinated fees that are proportional to the residual interest available to the equity class. For a more detailed discussion, see [Kundu \(2023\)](#).

among the coverage covenants. These par-based covenants effectively ensure that a CLO is sufficiently collateralized to mitigate the risk of default. In other words, these covenants create cushions for principal losses for more senior tranches.¹⁰

If the credit quality of loans held in a CLO deteriorates, the par-based coverage covenants (“par-based covenants”) may bind.¹¹ Triggering the par-based covenants has a detrimental effect on a CLO, as it leads to the diversion of proceeds from the underlying loans away from junior tranches, junior management fees, and equity distributions. Instead, these funds are allocated towards the early repayment of liabilities in order of seniority or the acquisition of “higher-quality” collateral. Covenant violations have significant financial and reputational implications for the CLO manager.¹² However, I show that as loan values deteriorate, managers can undertake specific actions to prevent these covenants from being triggered. Before turning to these actions, I explain how par-based covenants are calculated.

The calculation of the par-based covenants relies on determining the value of loans according to a set of accounting rules. The par-based covenants — the overcollateralization (OC) and interest diversion (ID) covenants — are measured in a similar manner to leverage. The ID covenant, the most stringent par-based covenant, is triggered before all other par-based covenants. In the calculation of the ID covenant, loans are typically valued at their par value and are not affected by market fluctuations unless they meet certain risk criteria, such as (1) default, (2) discount obligation, or (3) a rating of CCC or below, exceeding the CLO limit. In such cases, the loans’ market values often exceed their recorded values. Defaulted loans are marked at the lower of their market values and recovery values. Discount obligations are marked to their purchase prices until they trade above a threshold (typically 90¢/\$) for more than 30 days, and loans in excess of a CCC limit are marked at their market values, starting with the lowest priced loans (e.g., [Hu and Saykovskyi \(2019\)](#); [CreditFlux \(2020\)](#); [Scaggs \(2020\)](#); [Cioffi \(2020\)](#); [GSO Capital Partners \(2020\)](#); [Fleckenstein \(2022\)](#)). Equation 1 illustrates the impact of various types of collateral on the calculation of the ID covenant:

$$ID = \frac{\text{Par value of collateral} + \text{Defaulted collateral value} + \text{Purchase price of discounted collateral} - \text{“CCC” excess adjustment}}{\text{Principal balance of tranche and all senior tranches}}. \quad (1)$$

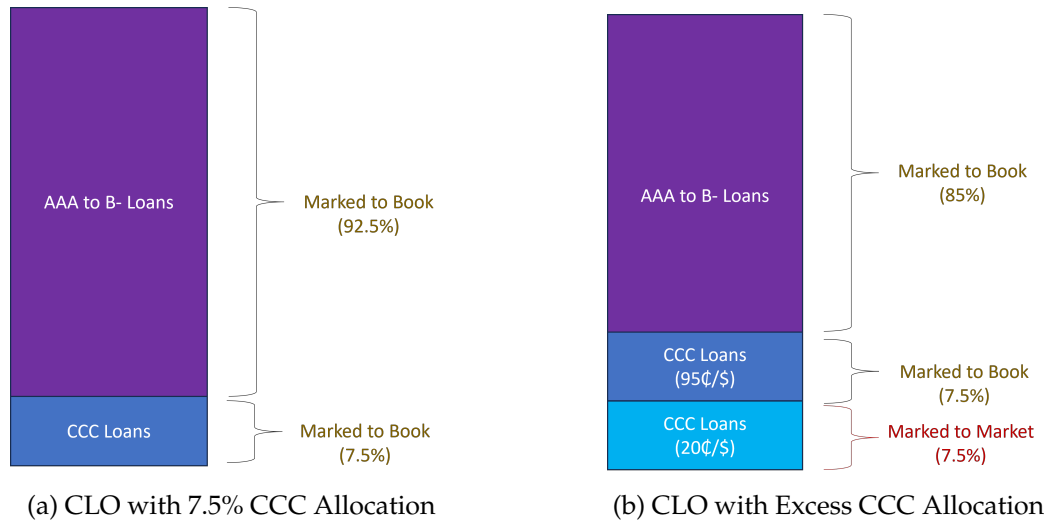
¹⁰CLO contracts include various covenants designed to manage risk and maintain portfolio quality. These covenants fall into two main categories: coverage covenants and quality covenants. Quality covenants impose constraints to maintain or improve the credit quality of the portfolio. If triggered, the CLO manager must take action to maintain the portfolio’s credit quality. Common quality covenants include: concentration limits, as well as covenants including weighted average rating factor (WARF), weighted average spread (WAS), and weighted average life (WA Life).

¹¹In addition to par-based covenants, CLO contracts typically include interest coverage (IC) covenants as part of their coverage covenants. These covenants require that interest income from the underlying collateral exceeds specified threshold levels relative to the interest due on each tranche.

¹²First, fees and payments may be siphoned off from the manager and other junior stakeholders. These constraints may hinder the manager from making portfolio-enhancing trades. Second, investors may also lose confidence in the manager’s ability to administer the CLO portfolio. If CLO failures persist, i.e., the manager serially breaches contractual provisions, the manager may be dismissed. Further, if the underlying loans default, equity holders may elect to not exercise the call until the defaulted loans rebound in price. These ramifications may result in a CLO operating well-beyond its expected call date until legal maturity. [Kundu \(2024\)](#) explores some of the costs of covenant violations.

This piecewise design of covenants significantly influences the incentives of CLO managers in their liquidation behavior. For example, CLOs are generally restricted to having a maximum of 7.5% of their portfolio allocated to CCC rated loans. CCC loans in excess of this limit are marked at their market values, starting with the lowest priced loans. The following example illustrates how CLO managers can take specific actions to loosen their covenant constraints.

Figure 1: CLO Accounting of CCC Loans



Notes: This figure illustrates an example of how two CLOs account for CCC loans. Both CLOs have a maximum allocation of 7.5% for CCC loans. In Figure 1a, the CLO has 7.5% of its portfolio in CCC loans, and all loans are marked at book value since they are within the limit. In Figure 1b, the CLO exceeds the 7.5% limit with 15% of its assets in CCC loans. Of this 15%, 7.5% have a market value of 20¢/\$ and the other 7.5% have a market value of 95¢/\$. The excess 7.5% of loans are valued at 20¢/\$ in Figure 1b.

Figure 1a illustrates that a CLO holding up to 7.5% of its assets in CCC rated loans values those loans at book value, while Figure 1b illustrates that when a CLO exceeds the 7.5% allocation, for example, by another 7.5%, the excess 7.5% is marked at market value. Notably, these loans are marked at market value starting from those with the lowest market values.

The CLO in Figure 1b can improve its covenants by strategically selling loans with higher market values than recorded values. Suppose 7.5% of the CCC loans have a market value of 20¢/\$ and 7.5% have a market value of 95¢/\$. As the CLO is restricted to having a maximum of 7.5% of its portfolio allocated to CCC rated loans, the excess 7.5% is valued at 20¢/\$. By selling the 7.5% portion that trades at 95¢/\$, the CLO can realize higher market values and effectively avoid breaching the 7.5% limit. This preemptive sale relaxes the par-based covenants. A numerical example is provided in Appendix Section A.1. In Appendix Section A.2, I generalize this example to demonstrate how a CLO can strategically maximize improvements to the par-based covenants by selling risky loans that exhibit higher market values than their recorded values, starting from the loans that recover the highest market values. Similar to the case of CCC loans, if the agency-projected recovery rate of a defaulted loan is below its market value, or, if the purchase price of a discount obligation is below its current market valuation, the CLO can build par by liquidating the defaulted or discounted loan and realizing its market value. In Section 5, I show that CLOs liquidate

positions when their covenants tighten. In Section 6, I come back to these specific incentives and assess whether CLOs liquidate optimally.

3 Data Sources

To establish a causal relationship between covenant tightening and its real effects, I leverage detailed microdata on the composition of CLO portfolios and their evolution over time. I assemble several datasets, which serve to effectively delineate the causal pathway connecting tighter covenants to fluctuations in asset prices and firm dynamics. The primary period of focus for this study spans from 2013 to 2015.¹³

The primary data source is the Creditflux CLO-i Database ([Creditflux, 2021](#)), which provides information from over 35,000 trustee reports, prospectuses, and covers over 1,200 CLOs in the US.¹⁴ Creditflux provides granular data on CLO transactions and their associated prices, holdings, covenants, tranches, and equity distributions. The CLO-i database covers 52%-68% of the market for my sample period from 2013 to 2015.¹⁵ On average, each issuer's loans are held in 125 CLOs and total to \$230 million. I limit my analysis to firms that received a syndicated loan, as indicated in DealScan, to ensure comprehensive coverage across datasets. The processed data covers 1,631 distinct issuers.

I collect additional financial data from WRDS-Refinitiv's LPC DealScan ([Refinitiv LPC, 2021](#)), the WRDS Bond Database ([Wharton Research Data Services, 2021](#)), and CRSP ([Center for Research in Security Prices, CRSP](#)). Specifically, I use LPC DealScan for data on primary issuance, the WRDS Bond Database for bond credit spreads and liquidity information, and CRSP for monthly equity returns.

For firm characteristics, I use two databases from S&P Capital IQ: Compustat North America (Compustat) ([S&P Global Market Intelligence, 2021b](#)) and Capital Structure ([S&P Global Market Intelligence, 2021a](#)). I describe the construction of firm-level variables from Compustat in Appendix Section C. In addition, I use Capital Structure data to understand the dynamics of firm liquidity, specifically, data on lines of credit. Both datasets are collapsed to the quarterly frequency. A limitation of my analysis is that Compustat reports data primarily for publicly held firms, whereas CLOs hold loans issued by both private and public firms.

I also use time-series macroeconomic data from the Federal Reserve Economic Data (FRED) database ([U.S. Energy Information Administration, 2021](#)). In particular, I obtain WTI crude oil prices to track the onset of the oil price decline beginning in June 2014, as well as subsequent price movements.

One significant hurdle is matching firms across datasets. There is no identifying code in the CLO-i database that allows for easy matching across databases. Case sensitivity, abbreviations, inconsistent syntax, punctuation, and the conflation of subsidiaries and holding companies are some of the issues that hinder automatic matching. Thus, I manually encode

¹³The findings are robust to a wider window around the shock.

¹⁴Spelling standardized to "Creditflux" throughout for consistency with the company's styling.

¹⁵I use the International Monetary Fund's figures on total outstanding US CLOs from 2013 to 2015 to compute this percent ([International Monetary Fund \(2020\)](#)).

the data and generate several crosswalks between the CLO-i database and other datasets. For completeness and correctness, I verify and supplement matches using fuzzy string matching, matching on the first six characters of the firm’s name, and the Roberts DealScan-Compustat Linking Database (Chava and Roberts, 2008b).

I summarize the main outcome variables used in this paper in Table 1. The table reports the distribution of CLO, capital market, and firm characteristics.

4 Empirical Strategy

This section describes the identification strategy used to examine how covenant tightening induces CLOs to sell loans and how those sales affect the financing costs and real outcomes of the firms whose loans are sold.

To fix ideas, consider the following thought experiment, which illustrates the ideal empirical design and is depicted in Figure 2. Imagine two CLOs operating in parallel universes, CLO A and CLO B, with asset portfolios drawn from the same underlying distribution of loans. Suppose that, due to a random act of nature, a single loan held by CLO B experiences an adverse shock, while any analogous loan in CLO A is left unaffected. This shock moves CLO B closer to its portfolio-level covenant thresholds, whereas CLO A remains at its baseline distance from those thresholds. The tightening gives CLO B an incentive to liquidate loans in order to restore compliance, including loans issued to firms that were themselves unaffected by the original shock.

The key question follows: how does a CLO’s proximity to its coverage thresholds affect the financing costs and real economic outcomes of the otherwise-unaffected firms whose loans it holds? Identification comes from comparing these firms in CLO B’s portfolio to comparable firms in CLO A’s portfolio. Because the triggering shock is unrelated to the fundamentals of the unaffected firms, and is transmitted to them only through their lender’s portfolio constraint, any divergence in their outcomes can be attributed to CLO B’s heightened incentive to sell rather than to the firms’ own conditions.

4.1 Identification Strategy

I exploit variation from a natural experiment to identify the mechanism described above. Specifically, I use a shift-share design that compares outcomes for non-oil and gas (non-O&G) firms held by CLOs with different exposures to O&G loans before and after the June 2014 oil price collapse (Bartik, 1991).¹⁶ This specification relies on two key assumptions: the exogeneity of the O&G shock to the leveraged loan and CLO markets, and the absence of selection or matching in the composition of CLO portfolios. In other words, the O&G shock was unexpected, and a CLO’s exposure to the O&G industry is orthogonal to the composition of

¹⁶The incidence of firm distress may be correlated with omitted characteristics of the associated CLO. Using the variation in oil price changes circumvents concerns of matching between CLOs and portfolio firms. This is discussed later in Section 4.3.

the remainder of its portfolio. I discuss the plausibility of these assumptions in the subsequent subsections.

Under these assumptions, I identify the effect of O&G exposure on CLO outcomes around the O&G price plunge using the following specification:

$$Y_{c,t} = \beta_0 + \beta_1(\text{CLO O\&G Exposure})_c + \beta_2(\text{Post})_t + \beta_3(\text{CLO O\&G Exposure}_c \times \text{Post}_t) + \gamma'_0 X_c + \alpha_c + \alpha_t + \epsilon_{c,t}, \quad (2)$$

where c indexes CLOs and t indexes time. X_c denotes a vector of time-invariant controls, including CLO age, size, defaulted share, and CCC share. $\text{CLO O\&G Exposure}_c$ is the share of O&G loans in CLO c , measured prior to the oil price shock, and Post_t is an indicator equal to one after the oil price plunge and zero otherwise. $Y_{c,t}$ denotes CLO-level outcomes, including covenant tightness, defined as the distance to the ID threshold and measured as the natural logarithm of the ratio of the covenant value to the covenant threshold.

I then turn to the firm level to examine how non-O&G firms' indirect exposure to the O&G industry through CLO holdings affects their outcomes. I construct firm-level exposure to the O&G industry by interacting firms' exposures to CLOs with the CLOs' pre-shock shares of O&G loans.

$$\text{Firm O\&G Exposure}_f = \sum_{c \in C} w_{f,c} \times s_{\text{O\&G},c} \quad (3)$$

where $w_{f,c}$ denotes firm f 's exposure to CLO c , defined as the ratio of the volume of loans issued by firm f and held by CLO c to the total volume of loans issued by firm f . $s_{\text{O\&G},c}$ denotes the share of O&G loans in CLO c , measured prior to the oil price shock.

The impact of (non-O&G) firms' exposure to the O&G industry through CLOs on their outcomes is estimated according to the following specification:

$$Y_{f,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure})_f + \beta_2(\text{Post})_t + \beta_3(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \alpha_f + \alpha_{m,y} + \epsilon_{f,t}, \quad (4)$$

where $\text{Firm O\&G Exposure}_f$ is measured prior to the oil price shock. Post_t is an indicator variable equal to one after the O&G price plunge and zero otherwise. The index t denotes time, while m and y denote month and year, respectively. Throughout the paper, I use the phrase "a firm's exposure to O&G" to refer to a non-O&G firm's exposure to the oil and gas industry through its links to CLOs.

The sample period of study is 2013-2015, which is a window around the O&G price plunge. In the remainder of this section, I discuss the assumptions underlying the methodology and address related concerns.

4.2 Exogeneity of O&G Shock

A concern with the identification strategy is the exogeneity of the O&G price shock to CLO and leveraged loan markets. If the O&G shock is not exogenous, it may be correlated with the error terms in the empirical design, causing the estimator to be inconsistent. In this section, I argue that the O&G price plunge is exogenous.

Figure 3 exhibits the average crude oil price (\$ per barrel) from 2012 through 2017. The oil price precipitously dropped by 75% from \$107.95 per barrel of crude in June 2014 to \$26.68 in January 2016. The plunge lasted until 2016, making this, at the time, one of the three largest oil price declines since World War II and the longest-lasting since the supply-driven price plunge of 1986 (Stocker, Baffes and Vorisek, 2018).¹⁷ Baumeister and Kilian (2016) show that the sharp decline in oil prices in 2014–2015 was largely unanticipated by consumers, policymakers, and financial markets.

Several major factors contributed to the price plunge. First, booming shale production in the US and improvements in fracking technology reduced the break-even prices of shale production.¹⁸ Specifically, post-crisis financing conditions facilitated developments in hydraulic fracking and horizontal drilling, improving oil extraction.¹⁹ Given the shorter life cycle of these projects and lower capital cost relative to conventional extracting methods, shale production presented itself as a viable substitute to conventional crude production in the wake of the price plunge, as it is more elastic to oil price changes than crude oil (Baffes et al., 2015; Krane and Agerton, 2015; McCracken, 2015). Second, OPEC announced a shift in policy, renouncing price targeting in November 2014, partly, in response to the increasing shale share of the global oil supply. The oil price experienced a 51% decline in the following 83 days after the announcement (Baffes et al., 2016). Third, receding geopolitical tensions allowed oil production to function without disruption or conflict, hence, supply remained steady. Fourth, the appreciation of the US dollar beginning in June 2014 increased the local cost of oil in countries where the currency was not pegged to the dollar. This increase contributed to “weaker oil demand in those countries and greater supply from non-US dollar producers” (Baffes et al., 2015). Although some demand shocks also occurred contemporaneously, for example, the stock market turbulence in China reduced demand for oil, consensus has formed around supply-driven factors as dominant contributors to the oil price plunge (e.g., Arezki and Blanchard, 2014; Hamilton, 2014). While I cannot identify the exact root cause of the O&G shock among these mechanisms, all of these explanations share a common characteristic: they are unrelated to the leveraged loan and CLO markets, which is what is needed for the identification strategy to be valid.

¹⁷The subsequent COVID-19 pandemic in 2020 would produce an even steeper decline.

¹⁸For example, shale production in the US totaled 2,116 billion cubic feet in 2008. It increased to 13,447 billion cubic feet in 2014. See data from the [US Energy Information Administration](#).

¹⁹Other developments that increased oil extraction include increased biofuel production and extraction from Canadian oil sands.

4.2.1 O&G Credit Deterioration and Covenant Pressure

Having documented the shock's supply-driven origins and exogeneity to loan markets, I next examine how the oil price collapse activated covenant pressure through rapid deterioration in O&G credit quality. Understanding the pre-shock characteristics of O&G loans and their post-shock migration is essential for two reasons. First, it clarifies why a sector-specific shock in a relatively small industry could generate system-wide covenant pressure through the piecewise, par-based covenant rules described above. Second, it reconciles an important feature of the data: O&G exposure supported covenant slack during the commodity boom, and generated outsized covenant pressure once the shock materialized.

Figure 4 provides descriptive evidence on credit quality, pricing, and credit migration for O&G loans relative to non-O&G loans. These patterns illustrate how an adverse shock to a specific sector can generate disproportionate covenant pressure through rating-based haircut mechanisms, rather than through broad-based deterioration in portfolio credit quality.

Panel (a) compares the pre-shock rating composition of O&G and non-O&G loan portfolios. O&G loans were more concentrated in the BB rating category compared to non-O&G loans (16% of O&G portfolios versus 8% for non-O&G). Importantly, the overall rating distributions were similar: both portfolios were predominantly speculative grade, with the majority of exposure concentrated in the BB–B range. Non-O&G loans exhibited slightly greater exposure to single-B ratings (34% versus 29%), while investment-grade exposure was negligible for both groups. Thus, while sectoral composition differed, O&G and non-O&G loans entered CLO portfolios with broadly comparable baseline credit quality prior to the shock.

Panel (b) shows interest rates by rating category in the pre-shock period. Conditional on rating, O&G and non-O&G loans carried broadly comparable spreads, particularly in the BB and B ranges where O&G exposure was concentrated. For example, BB-rated O&G loans paid approximately 4.0% compared with 3.5% for non-O&G loans, ruling out a large, pre-anticipated crash premium.²⁰ The stability of within-rating pricing through May 2014 supports the interpretation that the oil price collapse was unexpected in both timing and magnitude.

Importantly, while risk-adjusted pricing was similar, O&G loans outperformed during the commodity boom. Higher yields combined with strong credit performance, lower default rates and stable ratings, meant that CLOs with greater O&G exposure maintained larger covenant buffers prior to the shock (later discussed in Section 5.1). This pre-shock outperformance strengthens identification: had the downturn been anticipated, CLOs with high O&G exposure would have operated closer to covenant thresholds as a precaution. The sharp post-shock reversal, from above-average covenant slack to acute covenant pressure, therefore reinforces the unanticipated nature of the collapse.

Panel (c) documents credit migration within the O&G portfolio following the June 2014 shock. The rating distribution shifted sharply toward lower categories: the share of B-rated

²⁰The higher average yields on O&G loans may reflect compensation for general sector cyclicalities in normal times rather than anticipation of an imminent and severe downturn.

loans increased from 29% to 35%, while CCC-rated exposure rose from about 1% to nearly 5%. This migration was mechanically important for CLO covenants. Under par coverage tests, CCC-rated loans in excess of the 7.5% limit are marked at market value, typically implying haircuts of roughly 30–35%. Thus, a downgrade from B to CCC could reduce a \$100 face-value loan to \$65–\$70 of par coverage, a 25–30 percentage point decline. The concentration of downgrades in this range created outsized covenant pressure relative to O&G’s share of total collateral.

These patterns have direct implications for the contractual arbitrage mechanism and help explain the time-series pattern of the distance to the covenant threshold, documented later in Section 5.1. When O&G loans were downgraded from BB or B into the CCC bucket (Panel c), they moved from par valuation to market-value. For CLOs near the 7.5% CCC limit, these downgrades generated exactly the incentive structure illustrated in Figure 1b: managers were incentivized to sell higher-priced CCC loans to avoid marking the lowest-priced loans to market value.

Taken together, Figure 4 establishes three key facts that motivate the empirical analysis. First, O&G and non-O&G loans exhibited similar speculative-grade rating distributions and comparable within-rating pricing before the shock, supporting the parallel trends assumption. Second, the oil price collapse triggered rapid credit migration that concentrated downgrades in rating categories subject to the largest par haircuts under CLO covenant rules. Third, this migration activated the contractual arbitrage mechanism, creating incentives for CLOs to rebalance portfolios by selling loans to rebuild par coverage – the fire-sale channel examined in the remainder of the paper.²¹

4.3 Selection and Matching of CLO Portfolios

A potential concern with the identification strategy is that matching between CLOs and firms may not be random. In particular, CLOs with higher O&G exposure may differ systematically from those with lower exposure, which could bias the results if these differences influence firm selection. To address this concern, I conduct a set of analyses examining portfolio composition and pre-existing trends, finding little evidence that selection drives the results.

First, I examine whether CLOs with different levels of O&G exposure differ systematically prior to the shock. I find that (i) CLO portfolios exhibit substantial overlap in loan holdings; (ii) the ID covenant threshold does not vary with O&G exposure before the shock; (iii) the distribution of investments across non-O&G industries is similar across CLOs; (iv) geographic investment patterns do not differ meaningfully across states; (v) firm

²¹One limitation of this descriptive exercise is that it focuses on loans held within CLO portfolios. A substantial fraction of O&G loans were also held by banks, mutual funds, and other institutional investors, many of which reduced exposure following the oil price collapse. Because sales outside of CLOs are not observed in the CLO collateral data, the credit migration documented in Figure 4 likely understates the full extent of market-wide deterioration. Moreover, the most severely distressed loans are likely to exit CLO portfolios early, further attenuating observed post-shock migration within CLOs. As a result, the patterns documented here should be interpreted as a lower bound on the credit deterioration and selling pressure generated by the O&G shock.

characteristics are comparable across CLOs with high and low O&G exposure; and (vi) firms' sensitivity to oil prices does not predict inclusion in CLOs with greater or lesser O&G exposure. Taken together, these findings indicate that systematic selection into CLOs based on O&G exposure is unlikely. Detailed results are reported in Appendix Section B.

Second, I examine pre-trends in Figure 5. The figure shows that the relationship between O&G exposure and both covenant distance and the incidence of secondary loan sales shifts sharply following the O&G price plunge, consistent with the proposed amplification mechanism. I discuss this evidence in detail in the next section.

5 Main Results

This section reports the main findings of the paper. I present direct evidence that CLOs exposed to the O&G sector experience tighter covenants following the O&G shock. I further show that CLOs with greater O&G exposure respond by liquidating substantially larger volumes of loans. These covenant-driven liquidations have broad implications for asset prices across multiple security markets and for real economic activity.

5.1 O&G and Covenant Pressure

The O&G price collapse in June 2014 led to a sharp deterioration in CLO covenant performance, with distance to the most stringent covenant threshold falling past levels last observed during the 2008–2009 financial crisis. Figure 6 plots the evolution of distance to the minimum threshold among par-based covenants from 2009 through 2019.

The time-series pattern reveals several salient features. Distance to the covenant threshold varies substantially over time, declining sharply during episodes of credit stress and recovering during more stable periods. Prior to the O&G shock, the average CLO operated with a distance of roughly 3–4% above its binding threshold, consistent with industry practice of maintaining modest buffers to preserve financial flexibility while maximizing leverage.

The O&G price collapse triggered an abrupt deterioration in covenant performance. Between June 2014 and late 2015, average covenant distance declined from approximately 1.04 (a 4% buffer) to 0.95 (a 5% violation), a contraction of roughly 9 percentage points. This deterioration brought CLOs closer to covenant thresholds than at any point since the 2008–2009 financial crisis, when widespread defaults and credit market disruptions pushed many vehicles into technical covenant breaches. For CLOs near the margin of compliance, the shock was sufficient to trigger violations, redirecting cash flows from equity holders to senior noteholders and creating strong incentives to rapidly improve covenant ratios through asset liquidations. On average, CLOs breached their most stringent covenant during the height of the O&G crisis.

The subsequent recovery was gradual. Although covenant distance began to improve in 2016 as oil prices stabilized and distressed loans were liquidated, CLOs did not return to pre-shock levels until 2017, nearly three years after the initial shock. This prolonged impairment reflects both the persistent effects of O&G-related defaults on CLO portfolios

and the time required to rebuild covenant buffers through portfolio rebalancing and loan amortization.

The magnitude and persistence of this covenant deterioration are economically significant. The finding that an industry-specific shock in a relatively small sector can generate system-wide covenant pressure highlights the fragility of CLO capital structures and the potential for localized credit deterioration to propagate across the broader corporate credit market. This is consistent with contemporaneous market reports documenting severe distress in CLO portfolios. By October 2015, the O&G sector accounted for the largest share of distressed collateral in US CLOs, with the percentage of loans trading below 90¢/\$ (the typical threshold for discount obligations) reaching its highest level.²² Moreover, the pattern aligns with Figure 4, which shows that O&G distress led to widespread credit rating downgrades: the share of O&G loans rated CCC or worse increased almost fivefold.

5.1.1 Cross-Sectional Variation: O&G Exposure and Covenant Distance

Having documented the aggregate deterioration in CLO covenant distance, I next examine whether greater ex ante exposure to the O&G industry amplifies covenant pressure at the CLO level.

Figure 7 provides visual evidence of this relationship. The binscatter reveals a strong negative association between CLOs' pre-shock O&G exposure and post-shock covenant distance: CLOs with greater ex ante O&G exposure experience systematically tighter covenants following the crisis. This pronounced pattern supports the identifying assumption that O&G exposure serves as a meaningful proxy for covenant pressure.

Table 2 tests this relationship rigorously during the 2013-2015 period surrounding the shock. The specification includes manager and CLO fixed effects to control for time-invariant differences in CLO specialization, risk aversion, reputation, among other factors that might correlate with both O&G exposure and covenant management.

Column 1 shows that a one percentage point increase in a CLO's ex-ante O&G share is associated with a 0.27% decline in the distance to the covenant threshold following the shock, using a within-manager estimator. I augment this specification in columns 2-4 by introducing CLO-level controls and higher-dimensional fixed effects. Column 2 adds CLO age and year fixed effects. Column 3 further includes CLO size and month-year fixed effects to absorb common time-varying shocks. Column 4 incorporates the shares of CCC-rated loans and defaulted loans, which directly affect par-based covenant calculations. Across these specifications, the coefficient remains stable: a one percentage point increase in the ex-ante O&G share is associated with a 0.21% to 0.26% decline in covenant distance. Columns 5 and 6 further employ a within-CLO estimator to control for all time-invariant characteristics of

²²The average mark on O&G loans in CLO portfolios was approximately 80¢/\$, with the lowest-priced loans marked below 40¢/\$. Approximately 22% of US loan exposure to O&G was marked below 70¢/\$, 11% below 60¢/\$, and 8% below 50¢/\$ (Sallerson, 2015). Specific examples include Vantage Drilling Company (39.4¢), Samson Resources Corporation (15.9¢), Sabine Oil & Gas (20.7¢), and Ascent Resources (26.5¢) (Haunss, 2015; Sallerson, 2015).

CLOs, including manager, strategy, vintage, and baseline risk profile.²³ The point estimates remain both statistically and economically stable: a one percentage point increase in ex-ante O&G share is associated with a 0.23% to 0.24% decline in covenant distance. The consistency of results across manager fixed effects (columns 1-4) and CLO fixed effects (columns 5-6) confirms that the relationship between O&G exposure and covenant pressure is not driven by manager-specific strategies or time-invariant CLO characteristics.

The economic magnitudes are substantial. Between 2009 and 2019, the median CLO operated with a distance of only 3.37% above the binding covenant threshold. The baseline estimates imply that a CLO with a 10% O&G exposure experienced a 2.3 percentage point decline in covenant distance, consuming roughly 68% of the median buffer. As managers approach potential violations of par coverage covenants, which can redirect cash flows from equity holders, including managers' performance fees, to senior noteholders, they face strong incentives to preemptively liquidate risky assets, even at capital losses, in order to restore covenant compliance.²⁴

5.1.2 Robustness: Extended Sample Period

To verify that results are not specific to the 2013-2015 window, I extend the analysis to the full 2009-2019 period, spanning the post-financial crisis recovery, the O&G collapse, and subsequent normalization. This longer panel provides a robustness check against sample selection and period-specific patterns, and allows examination of covenant violations, a binary measure indicating whether CLOs breach covenant thresholds. Because violations are relatively rare events, the extended sample provides sufficient statistical power to detect effects on this intensive margin that are not apparent in the shorter 2013-2015 window.

Panel A of Appendix Table B.4 presents covenant distance estimates over the extended sample. A one percentage point increase in pre-shock O&G share is associated with a 0.37-0.78% decline in covenant distance following the June 2014 shock. The consistency of negative and statistically significant coefficients across the extended window confirms that covenant pressure from the O&G shock is not an artifact of the specific 2013-2015 timeframe.

Panel B examines covenant violations, defined as ID test ratios falling below contractual thresholds. Violations trigger automatic cash-flow diversion from junior to senior tranches, substantially intensifying incentives for preemptive deleveraging. A one percentage point increase in O&G exposure raises the probability of covenant violation by 1.13 to 3.13 percentage points after the shock, translating to a 16-45% increase relative to the baseline.

²³Control variables such as age, size, and portfolio composition are measured as of the pre-shock period and are thus absorbed by the CLO fixed effects in columns 5 and 6. The identifying variation comes from changes in covenant distance within the same CLO over time as a function of its pre-determined O&G exposure.

²⁴Indeed, CLOs preemptively sell distressed loans several months before defaults are formally realized (Kundu, 2024), indicating that even the threat of covenant pressure – not just actual violations – can trigger fire sales.

5.1.3 Dynamic Evolution and Economic Magnitude

In this section, I examine the evolution of covenant pressure and asset prices around the O&G shock. Figure 5a plots the relationship between firm O&G exposure and secondary loan prices over time, while Figure 5b plots the corresponding relationship between CLO O&G exposure and covenant distance.

Figure 5a shows that prior to the shock, secondary loan prices display no pre-shock differential trends in the event-study: firms with high and low CLO O&G exposure trade at similar prices. Following the shock, this relationship changes sharply. Greater O&G exposure becomes associated with pronounced price declines that persist for approximately 18–24 months before gradually reverting. By late 2017, price differentials have largely closed, and high- and low-O&G-exposure firms trade at comparable levels, consistent with the reversal in Figure 6. This reversion pattern is informative about the underlying mechanism. The return of prices to pre-shock levels rules out persistent deterioration in the fundamentals of non-O&G borrowers. Instead, the transitory nature of the price effects is consistent with covenant-driven liquidations: as CLOs complete portfolio rebalancing and liquidation pressure subsides, market prices revert to levels that reflect underlying credit fundamentals.

Figure 5b presents a striking contrast. CLOs with greater O&G exposure actually operated farther from covenant thresholds in the pre-shock period, reflecting the favorable performance of O&G loans during the commodity boom.²⁵ Following the shock, this relationship reverses sharply: greater O&G exposure becomes associated with progressive covenant tightening. Unlike secondary prices, which recover by late 2017, covenant distance shows persistent deterioration with limited reversion.

²⁵This pre-shock pattern could raise concerns about selection. For example, CLOs with greater covenant headroom may have deliberately taken on more O&G exposure, or managers specializing in O&G lending may have been more sophisticated and therefore maintained larger covenant buffers. Several pieces of evidence mitigate these concerns. First, the oil price collapse was largely unanticipated by market participants. Professional forecasters systematically failed to predict the 2014–2015 oil price decline (Baumeister and Kilian, 2016). This lack of foresight rules out the possibility that CLOs with higher O&G exposure knowingly assumed greater risk or that firms strategically avoided high-O&G lenders in anticipation of the shock. Second, the pre-shock difference in covenant distance operates in the opposite direction of what would generate spurious post-shock effects. If high-O&G-exposure CLOs were systematically better capitalized or more conservatively managed, this would bias the analysis against finding post-shock covenant pressure, as these CLOs would have greater capacity to absorb losses. The fact that covenant deterioration is nonetheless sharp strengthens the causal interpretation. Third, Appendix Table B.1 shows that conditional on observables, including manager fixed effects, vintage year, and CLO size, there is no systematic relationship between O&G exposure and pre-shock covenant distance. The unconditional correlation in Panel B instead reflects broader commodity-cycle dynamics. During the pre-shock boom, O&G loans performed well, generating higher interest income and fewer defaults for CLOs holding them (see Figure 4). The observed correlation therefore reflects commodity market conditions rather than persistent differences in manager quality or risk management practices. Finally, if firms with weaker fundamentals systematically borrowed from high-O&G-exposure CLOs, price differentials should persist over time. Instead, Panel A shows that price effects are transitory and fully reverse by late 2017, consistent with temporary liquidation pressure rather than permanent differences in borrower quality. Appendix Table B.2 further shows no observable differences in firm fundamentals between borrowers linked to high- and low-O&G-exposure CLOs. Additional discussion appears in Section B.

5.2 Fire Sales of Non-O&G Loans

This section documents CLO loan liquidations in response to tightening covenants, measured using ex ante O&G exposure. I examine the relationship between firm-level O&G exposure and secondary-market transaction volumes (in millions of dollars) following the oil price collapse. Table 3 reports the results. The outcome variable is measured in dollar terms, with negative (positive) values indicating net sales (net purchases). In column 1, I do not include any fixed effects. Columns 2-6 incorporate additional fixed effects, including manager, rating-industry, issuer-loan type, year, and month-year, to account for potential confounding factors such as changes in issuer demand, aggregate shocks, and variation across loan characteristics. I find that the point estimate remains negative, statistically significant, and economically meaningful, even after including high-dimensional fixed effects. Across all estimates, a one percentage point increase in a firm's O&G exposure is associated with a \$157K to \$196K decrease in the transaction amount after the shock. This represents a substantial decline of up to 60% of the average transaction amount. Given the sign convention, the negative coefficient means that higher O&G exposure shifts net flows toward more selling (or less net buying), rather than simply indicating a drop in gross trading volume.

To study whether these patterns hold at a coarser level, I estimate the relation between firm O&G exposure and the total amount transacted at the CLO-issuer level around the O&G price plunge. For each issuer in a given CLO, I aggregate across all transactions. Consistent with the previous findings, firms with higher O&G exposure experience larger declines in the net transaction amount after the shock, as shown in Appendix Table B.5. These results remain statistically significant at the issuer-level as well in Appendix Table B.6.

It is important to note, however, that a decline in transaction amounts at the transaction, CLO-issuer, and issuer levels does not necessarily imply an increase in sales. Reduced purchases could lead to similar outcomes. To disentangle whether the effect is driven by an increase in sales or a decrease in purchases, I conduct a subsample analysis. Specifically, I examine how the net transaction amount at the issuer level differs for purchases and sales around the O&G price plunge. The results of this analysis are presented in Appendix Table B.7. The findings in columns 4-6 support the hypothesis that CLO selling pressure increases with O&G exposure after the shock. Additionally, the positive relationship between purchases and O&G exposure contradicts the idea that the effect is driven by a decrease in purchases.

5.3 Implications for Asset Prices

CLO liquidations in the secondary loan market generate price dislocations that propagate across capital markets. I first examine their impact on secondary loan prices and then study how these dislocations spill over to other securities, including primary loans and corporate bonds.

5.3.1 Secondary Loan Prices

Because CLOs are marginal investors in the secondary loan market, their liquidation activity is expected to have meaningful price effects. Specifically, I hypothesize that secondary loans issued by firms with greater exposure to O&G trade at lower prices compared to those issued by firms with lesser exposure to O&G after the shock.

To test this, I examine how the secondary loan price (per \$100 of notional par) varies with a firm's exposure to O&G around the O&G price plunge in Table 4. In column 1, I exclude fixed effects. The results indicate that a one percentage point increase in a firm's exposure to O&G is associated with a decline in the secondary loan price by \$2.69 (per \$100 par), after the shock. In columns 2-6, I incorporate additional fixed effects including manager, rating-industry, issuer-loan type, year, and month-year to account for potential confounding factors such as changes in issuer demand, aggregate shocks, and variation across loan characteristics. The point estimates remain statistically significant and economically meaningful across all columns. Specifically, moving from column 2 to column 6, I find that a one percentage point increase in a firm's exposure to O&G is associated with a \$0.98 to \$2.70 decline in the secondary loan price.

5.3.2 Primary Loan Prices

To understand how financial market dislocations propagate, this section examines the pass-through from secondary loan markets to primary loan pricing. Liquidations in the secondary market may tighten funding conditions for affected borrowers, leading to higher spreads on new issuances.

Table 5 shows that primary loan spreads on refinancing institutional loans increase with ex ante O&G exposure following the shock.²⁶ The outcome variable is the all-in-drawn spread, which represents the total annual spread above LIBOR for each dollar drawn from a loan.²⁷ Moving from column 1 to column 5, I sequentially add fixed effects to account for variation in non-price contract terms that could otherwise confound the relationship between loan prices and CLO covenant tightening. These fixed effects include issuer, loan type, issuer-loan type, secured status, loan purpose, distribution method, seniority, currency, country of syndication, year, and month-year fixed effects.

I find that a one percentage point increase in a firm's exposure to O&G is associated with approximately a 15 to 20 basis point increase in the primary loan spread after the shock. This corresponds to a change of up to 5% of the average loan spread. Despite the relatively small sample size, the results are statistically significant across all specifications.

I further examine how the non-price terms of loan contracts vary with O&G exposure after the shock to assess potential adjustments in other dimensions. Appendix Table B.8 shows that a one percentage point increase in a firm's exposure to O&G is associated with a reduction in loan maturity of approximately three to five months after the shock. This estimate

²⁶A term loan is deemed to be an institutional loan if it is not a term loan A facility.

²⁷The all-in-drawn spread includes the upfront fee, annual fee, utilization fee, and spread above LIBOR.

is negative, statistically significant, and economically meaningful across all specifications. Additionally, Appendix Table B.9 shows that a one percentage point increase in a firm's exposure to O&G is associated with a 6.58% to 8.70% decrease in the loan amount after the shock. Although the point estimates associated with the loan amount are negative, economically meaningful, and stable across specifications, they are not statistically significant.

5.3.3 Corporate Bond Spreads

When faced with tighter conditions in the loan market, affected firms may seek alternative financing in the bond market. However, segmentation arising from the limited and specialized investor base for syndicated loans can impede arbitrage across markets (e.g., [Shleifer and Vishny, 1992, 1997](#); [Gabaix, Krishnamurthy and Vigneron, 2007](#); [Mitchell, Pedersen and Pulvino, 2007](#); [Chernenko and Sunderam, 2012](#)). Moreover, because only a relatively small fraction of leveraged loan issuers have access to public bond markets, the scope for substituting toward other external financing sources is limited.

I empirically test this proposition by examining the sensitivity of bond credit spreads to firm O&G exposure around the O&G price plunge in Appendix Table B.10. To exploit temporal variation within issuers, I include issuer and bond-type fixed effects across all columns. In columns 2-6, I further control for various dimensions of bond heterogeneity, including time-to-maturity, security-level credit rating, investment-grade status, and default status, along with month-year fixed effects to account for common shocks. I find that a one percentage point increase in a firm's exposure to O&G is associated with a 24 to 33 basis point increase in the bond credit spread after the shock, representing up to a 10% change in the average bond credit spread. Additionally, bond liquidity deteriorates for firms with higher O&G exposure after the shock, as shown in Appendix Table B.11. Hence, the bond market does not provide better financing terms than the primary and secondary loan markets due to imperfect substitution between markets.

5.3.4 Persistence and Liquidity

Market Liquidity and Price Impact. The widening of bond bid-ask spreads and dislocated prices point to limited arbitrage capacity and impaired market liquidity. To quantify this mechanism, I construct a signed price-impact-per-dollar-of-flow measure, analogous to the Amihud illiquidity measure ([Amihud, 2002](#)). This measure captures the sensitivity of prices to net loan flows, where positive values indicate sales (outflows) and negative values indicate purchases (inflows). I hypothesize that firms with greater O&G exposure experience larger price responses per dollar of net selling pressure after the shock, reflecting deteriorated liquidity conditions.

Table 6 examines the relationship between firm-level O&G exposure and the price impact of loan flows. A one percentage point increase in O&G exposure is associated with an additional 190–526 basis point price decline for every \$1 million of net selling pressure. Put differently, for two otherwise similar firms, a \$1 million net sale generates a substantially larger

price decline for the firm with higher O&G exposure. These magnitudes exceed standard measures of illiquidity in corporate bond markets during the Great Recession. [Benmelech and Bergman \(2018\)](#) report a median Amihud measure of 57.7 basis points for corporate bonds, with interquartile values ranging from 18 to 159 basis points, while [Friewald, Jankowitsch and Subrahmanyam \(2012\)](#) document a median of 38 basis points and a 95th-percentile value of 260.7 basis points between October 2004 and December 2008. Together, these comparisons highlight the severity of liquidity shortages in the leveraged loan market and the limited capacity of arbitrageurs to absorb covenant-driven liquidations.

Persistence. Having established that covenant pressure induces CLO fire sales and depresses secondary loan prices, I next examine whether these financial market dislocations persist long enough to meaningfully affect firm behavior. Persistence matters for two reasons. First, if price effects are transitory, firms can simply postpone financing and investment decisions until markets normalize, limiting real consequences. Second, the degree of persistence helps identify the mechanism: purely mechanical selling should revert quickly, whereas sustained effects point to deeper liquidity and balance-sheet frictions.

To characterize the dynamic responses, I estimate Jordà-style local projections at both the loan and firm levels. For each horizon $h = 0, 1, \dots, 9$ quarters, I estimate:

$$Y_{f,i,t+h} - Y_{f,i,t-1} = \beta_1(h) (\text{O\&G Exposure}_f \times \text{Post}_t) + \alpha_i + \alpha_t + \varepsilon_{f,i,t,h}, \quad (5)$$

where $Y_{f,i,t}$ denotes the outcome for firm f , instrument type i , at time t ; α_i are issuer-loan type fixed effects; and α_t are quarter-year fixed effects. For firm-level outcomes, the specification replaces issuer-loan type fixed effects with firm fixed effects. The coefficient $\beta_1(h)$ measures the cumulative effect of a one percentage point increase in firm O&G exposure on the change in outcome from $t - 1$ to $t + h$, comparing the post-shock period to the pre-shock period. Because the shock occurs at the same calendar date for all firms, Post_t is equivalent to a calendar-time indicator. To make this transparent, [Figure 8](#) labels the x-axis with calendar quarters (2014Q2 through 2016Q3) rather than relative horizons.

[Figures 8a](#) and [8b](#) show that secondary prices and bond spreads respond immediately: prices fall and spreads widen sharply, peaking around 2015Q2, and then gradually revert toward baseline by 2016Q1. This pattern mirrors the event-study evidence in [Figure 5](#) and indicates that the liquidity-induced dislocation is persistent but not permanent. Importantly, the persistence is long enough to tighten borrowing conditions for issuers and thus to plausibly generate real effects.

Real variables adjust more slowly. Capital expenditures and leverage, shown in [Figures 8c](#) and [8d](#), exhibit delayed and persistent responses: investment begins to decline several quarters after the shock, reaching its trough around 2015Q3, while leverage falls monotonically and shows little reversion through 2016Q3. Although prices and spreads begin to revert by early 2016, the period of elevated financing costs spans multiple planning and refinancing cycles, leaving firms with limited scope to delay adjustment. As a result, firms curtail investment and reduce leverage in ways that outlast the peak of market stress. This

pattern of transitory financial dislocation followed by persistent real adjustment is consistent with contractual, covenant-induced liquidations rather than permanent deterioration in borrower fundamentals.²⁸

Why do dislocations persist? These patterns raise the question of why financial dislocations generated by CLO fire sales persist. Several reinforcing frictions help explain the slow normalization. First, capital in the leveraged-loan market is slow-moving: the natural buyers of loans, other CLOs, are themselves constrained by similar covenant pressures during crisis periods, due to overlapping portfolios, sharply limiting their ability to absorb sales (Shleifer and Vishny, 1992; Bozanic, Loumioti and Vasvari, 2018). With roughly 90% of CLOs exposed to at least one of the top 50 borrowers and more than 80% exposed to the top five (Board of Governors, 2019), the O&G shock produces correlated selling rather than offsetting flows. Second, dealer intermediation capacity is limited in this market. When many CLOs attempt to sell concurrently, dealer inventories tighten, bid-ask spreads widen, and price pressures amplify, consistent with models of constrained intermediation (Brunnermeier and Pedersen, 2009; Acharya, Almeida and Campello, 2013; He, Kelly and Manela, 2017). Third, information frictions may magnify withdrawals: large-scale selling by CLOs, viewed as informed, long-horizon investors, could signal deterioration and induce further retrenchment by other market participants (Duffie, Gârleanu and Pedersen, 2007; Coval, Jurek and Stafford, 2009; Goldstein, Jiang and Ng, 2017).

These effects arise during the relatively tranquil 2014–2015 period. In contrast, the COVID-19 O&G price collapse was far more severe. Section 7 shows that secondary loan price effects during this episode are up to four times larger than the baseline estimates, indicating that covenant-induced liquidations intensify markedly when market stress and arbitrage constraints are more pronounced.

5.4 Implications for Firms

Thus far, I have documented that fire sales originating from CLO covenants exert price pressure across capital markets. In this section, I examine whether persistent market dislocations have significant effects on firms. I show that as the liquidated firms struggle to find financing, they adjust their real activity. Specifically, I show that credit market dislocations erode the liquidity positions of exposed firms and affect firm real activity.

5.4.1 Impact on Firm Liquidity

As their effective cost of capital increases, firms may shift away from external financing and instead rely on existing lines of credit. I examine whether firms' exposure to O&G

²⁸The sequence of prices adjusting immediately, investment responding with a lag, and leverage declining persistently is consistent with standard models of financial-friction propagation (e.g., Bernanke and Gertler, 1989; Holmstrom and Tirole, 1997; Bolton, Santos and Scheinkman, 2011). The roughly four-quarter lag in capital expenditures aligns with typical corporate planning and implementation cycles (Campello, Graham and Harvey, 2010; Duchin, Ozbas and Sensoy, 2010), while gradual deleveraging can reflect amortization, reduced issuance, and other multi-quarter balance-sheet adjustments (Leary, 2009; Faulkender and Petersen, 2012).

influences a key component of corporate liquidity management – the availability of credit available through lines of credit – around the O&G price plunge.

Table 7 presents the results. In columns 1-3, the dependent variable is the change in drawn credit scaled by assets, while in columns 4-6, it is the change in credit line utilization rate. Across all specifications, I employ a within-issuer estimator. To account for aggregate shocks and sectoral heterogeneity, I include year fixed effects in columns 2 and 5, and quarter-year fixed effects in columns 3 and 6.

The results are robust across specifications. Firms with greater exposure to the O&G industry draw down their credit lines more aggressively following the shock. A one percentage point increase in firm-level O&G exposure is associated with a 0.10 percentage point increase in the quarterly change in drawn credit scaled by assets (column 3) and a 0.55 percentage point increase in the quarterly change in credit line utilization (column 6). Relative to sample averages of 0.06 percentage points for drawn credit and 0.43 percentage points for utilization, these effects represent substantial increases – approximately 167% and 128% of the typical quarterly change, respectively. This pattern indicates that firms with high CLO O&G exposure engage in aggressive liquidity drawdowns when their lenders face covenant pressure.

5.4.2 Impact on Firm Real Activity

While tapping into existing credit lines may provide firms with temporary liquidity, it may not fully replace other sources of credit or sustain real economic activity. Consequently, firms with greater exposure to the O&G industry may adjust their operations in response. To assess the real effects of cross-firm spillovers through CLO structures, I examine five key channels through which financial constraints may affect firm behavior: (1) financing, measured by long-term debt growth to capture credit constraints; (2) investment, measured by the investment-capital ratio to assess real capital formation; (3) innovation, measured by R&D growth to capture research and development activity; (4) organizational activity, measured by employment growth to assess labor adjustments; and (5) corporate activity, measured by acquisition expenditures to capture strategic investment and M&A activity. Additionally, I examine operating performance through sales growth and cash flow to assess overall firm health and liquidity.

Table 8 examines this adjustment by assessing how firms' exposure to O&G through CLOs influences various financial and real outcomes. Columns 1-7 analyze the impact on long-term debt growth, sales growth, cash flow, acquisitions, investment, R&D growth, and employment growth, respectively.²⁹ All specifications include issuer, industry, and quarter-year fixed effects. I find that a one percentage point increase in a firm's exposure to O&G is associated with a 0.89 percentage point (0.05 sd) decline in long-term debt growth, a 0.77 percentage point (0.04 sd) decline in sales growth, a 0.09 percentage point (0.04 sd) decline in cash flow, a 0.32 percentage point (0.04 sd) decline in investment, a 0.28 percentage point (0.05 sd) decline in acquisitions, a 1.82 percentage point (0.07 sd) decline in R&D growth,

²⁹The construction of these variables is described in Appendix Section C.

and a 1.82 percentage point (0.10 sd) decline in employment growth, after the shock. The magnitudes indicate that innovation and organizational adjustments (R&D and employment) are most affected, followed by financing constraints (debt growth), operating performance (sales growth) and strategic activity (investments and acquisitions). Section 6.5 formalizes the causal chain behind these estimates: instrumenting CLO net loan sales with O&G exposure, Panel B of Table 13 shows that a one-percentage-point increase in covenant-driven net loan sales reduces quarterly investment by 0.08 percentage points, approximately 5% of its sample mean. While these average effects appear modest relative to the cross-sectional dispersion, they mask substantial heterogeneity across the firm constraint distribution, which I examine next.

5.4.3 Heterogeneous Effects: Financial Constraints and Fire Sales

The preceding analysis establishes that CLO fire sales generate persistent dislocations in loan and bond markets and induce firms to draw down existing credit lines. However, these effects need not be evenly distributed across borrowers. Even among non-O&G firms, substantial heterogeneity exists in firms' ability to substitute across financing sources and absorb disruptions in syndicated loan markets. If CLO fire sales operate through a credit supply channel, their consequences should be most severe for firms that are financially constrained, face imminent refinancing needs, or lack access to alternative funding markets.

To examine this dimension, Table 9 partitions firms along three measures of financial vulnerability: bond market access, rollover risk, and loan refinancing timing. Across all three dimensions, the results show a consistent and economically meaningful pattern: fire sale effects are sharply concentrated among firms that are more financially constrained, while effects for less constrained firms are substantially smaller and, in several cases, statistically insignificant.

Bond Market Access. Columns 1-2 compare firms with and without access to public bond markets. For each one percentage point increase in O&G exposure, firms without bond market access experience transaction volume declines of \$0.20 million compared to \$0.12 million for firms with bond access. The disparity is even starker for secondary loan prices: firms without bond access experience price declines of \$2.26 per \$100 par, nearly four times the \$0.59 decline for firms with alternative financing. These financial disruptions translate into real effects: investment rates fall by 0.97 percentage points for firms without bond access, while firms with bond market access exhibit no statistically significant investment response.

This sharp divergence indicates that bond market access provides an important buffer against CLO-driven credit supply shocks. Firms that can substitute toward public debt markets are able to offset CLO selling pressure, whereas firms reliant exclusively on syndicated loans bear the full burden of the fire sale externality.

Rollover Risk. Columns 3-4 split firms by rollover risk, measured by proximity to loan maturity. For each one percentage point increase in O&G exposure, firms facing near-term

refinancing needs (maturing within six months) experience transaction volume declines of \$0.21 million – larger than the \$0.13 million decline for firms with low rollover risk. Price effects exhibit similar concentration: high-rollover-risk firms face price declines of \$1.96 per \$100 par compared to \$0.69 for low-risk firms. Investment effects are even more concentrated: high-rollover-risk firms experience investment declines of 2.58 percentage points, more than twelve times the effect for firms with distant maturities.

The concentration of effects among high-rollover-risk firms is particularly informative. These firms must refinance in the near term and are therefore highly sensitive to disruptions in loan market liquidity. The results suggest that CLO fire sales not only depress secondary market valuations but also materially impair firms' ability to roll over maturing debt precisely when refinancing needs are most urgent.

Loan Refinancing Timing. Columns 5-6 further restrict attention to firms without bond market access and examine whether the timing of refinancing matters. For each one percentage point increase in O&G exposure, firms that delay refinancing past mid-2015 experience transaction volume declines of \$0.21 million, secondary price declines of \$2.64 per \$100 par, and investment contractions of 1.05 percentage points. In contrast, firms that refinance early exhibit no statistically significant effects on any outcome.

This timing asymmetry provides strong evidence of a credit supply channel. If CLO selling reflected information about borrower fundamentals or broad deleveraging, firms refinancing early and late, or with and without bond access, should experience similar effects. Instead, the sharp divergence indicates that covenant-driven CLO liquidations generate acute financing constraints for firms that encounter the shock when alternative credit sources are unavailable. Early refinancers secure funding before covenant pressure intensifies, while late refinancers and firms without bond access face the full force of CLO deleveraging. The concentration of effects among firms with high rollover risk and limited financing flexibility is therefore difficult to reconcile with borrower-specific information effects or demand-driven explanations and is consistent with a credit supply mechanism rooted in contractual constraints in CLO structures.

6 Mechanism: CLO Distress and Cross-Firm Spillovers

This section presents evidence consistent with contractual arbitrage, whereby CLOs strategically liquidate distressed loans to improve par-based covenant ratios.

6.1 Conditions for Contractual Arbitrage

For contractual arbitrage to be feasible, a CLO must hold loans whose market values exceed the values at which they enter par coverage calculations. This condition arises naturally under CLO contracts because par-based covenants apply different accounting treatments across loan states, creating systematic wedges between market and accounted values for distressed assets.

I begin by showing that such wedges are common in practice. Distressed loans, particularly CCC-rated and defaulted loans, frequently trade above their accounted values, allowing CLOs to improve par-based covenant ratios through strategic sales. Figure 9 illustrates the distribution of prices for CCC-rated loans during the sample period. The average CCC loan trades at 78¢ per dollar of par, with the 25th and 75th percentiles at 67¢ and 97¢, respectively. At the same time, there is substantial dispersion within CLO portfolios: the lowest-priced CCC loan held by a given CLO averages 60¢, with an interquartile range from 35 to 88¢. This dispersion implies that CLOs often hold a mix of deeply discounted and relatively high-priced CCC loans.

Because CCC exposure above the 7.5% threshold is marked to market starting with the lowest-priced holdings, retaining the most deeply discounted CCC loans disproportionately erodes par coverage. In contrast, selling higher-priced CCC loans allows managers to realize market values and rebuild covenant slack, even though such sales still involve losses relative to par. Thus, CLO portfolios routinely contain loans trading at steep discounts, creating scope for par improvement through selective liquidation.

Appendix Figure B.3 shows that similar conditions arise for defaulted loans, which are subject to a distinct accounting regime. Upon default, loans are marked at the lower of projected recovery values or market prices rather than par, generating immediate par haircuts. Approximately 30% of defaulted loans trade above the 59.5% mean recovery rate documented by [Chen, Wang and Zhang \(2019\)](#), indicating that market prices frequently exceed recovery-based accounting values even for severely distressed credits. As a result, CLOs can improve par coverage by selling defaulted loans at prices that still generate accounting losses relative to par but exceed their recovery-based marks.

Taken together, these distributions show that the accounting conditions required for contractual arbitrage are routinely met across multiple categories of distressed assets. In the next section, I show that CLO managers systematically exploit these wedges by disproportionately liquidating loans for which covenant relief is greatest.

6.2 Discount vs. Premium Loan Sales

The evidence above establishes that the price distribution of risky loans allows CLOs to improve par-based covenant ratios through selective liquidation. A key implication of contractual arbitrage is that such improvements should be driven primarily by the sale of loans trading *below* par but above recovery values, rather than by the realization of gains on loans trading at a premium. An alternative hypothesis, however, is that CLOs can improve par coverage by systematically selling loans priced above par, using realized gains to offset losses elsewhere in the portfolio. To distinguish between these mechanisms, I examine how the propensity to sell premium versus discount loans varies with firm O&G exposure around the shock.³⁰

Table 10 presents the results. Panel A examines sales of loans trading above \$100 per

³⁰In these portfolio-level analyses, I continue using the firm-level CLO-weighted O&G exposure measure rather than the CLO's direct O&G share. This avoids mechanical endogeneity that would arise from using the CLO's

\$100 of par. Panel B examines sales of loans trading below \$90 per \$100 of par, the conventional threshold of discount obligations that reduce par coverage. The outcome variable equals 1 if a loan in the relevant price category is sold, and zero otherwise. I include issuer-loan type and month-year fixed effects to control for time-invariant loan heterogeneity and common shocks.

The results are inconsistent with the premium-sale hypothesis. Firms with greater O&G exposure experience a *decline* in the likelihood of selling premium loans in Panel A and a corresponding *increase* in the likelihood of selling discount obligations in Panel B. This pattern is consistent with contractual arbitrage: CLOs facing covenant pressure preferentially shed risky loans that hurt par coverage, even if this requires taking capital losses, while retaining premium loans that contribute positively to covenant ratios.³¹

6.3 Contractual Arbitrage: Targeting Distressed Borrowers

I next show that the effects concentrate among borrowers whose loans impose the largest par haircuts. Firms are classified as *distressed* if they meet any of the following criteria between 2013 and 2015: (i) their loans trade below 90¢/\$ in secondary markets, (ii) they experience CLO-reported defaults, or (iii) they carry CCC or worse credit ratings. These criteria map directly into par coverage calculations and jointly identify firms whose loans generate the largest par haircuts and exert the greatest covenant pressure. Loans trading below 90¢/\$ are treated as discount obligations and marked at purchase price rather than par until they trade above 90¢/\$ for more than 30 consecutive days, directly reducing par coverage. CLO-reported defaults trigger immediate haircuts, with defaulted loans typically marked at projected recovery values. Finally, CCC-or-worse loans that exceed the CLO's CCC limit are marked at market value, starting with the lowest-priced loans, mechanically reducing par coverage as credit quality deteriorates. Together, this composite measure captures all firms whose loans contribute most directly to covenant pressure through the par calculation mechanism.

Table 11 presents split-sample estimates comparing distressed versus non-distressed firms across four financing outcomes: secondary loan prices, primary loan spreads, bond credit spreads, and corporate investment. The results show that distressed firms experience large and pervasive effects across financial markets, whereas effects for non-distressed firms are economically smaller and generally statistically insignificant.

Columns 1 and 2 show that a one percentage point increase in O&G exposure leads to a 97 basis point decline in secondary loan prices for distressed firms, compared with a 54 basis point decline for non-distressed firms. While both estimates are statistically significant, the substantially larger magnitude for distressed firms indicates that fire-sale pressure is

O&G portfolio share, which is itself an outcome of the selling decisions I examine. The firm-level measure captures each firm's pre-determined exposure to covenant-constrained CLOs.

³¹Moreover, because leveraged loans are floating rate and frequently refinanced, extended periods of premium pricing are uncommon. Replicating the par gains from contractual arbitrage by selling premium loans may require substantially higher transaction volumes. Alternative strategies such as equity injection or debt deleveraging are costly responses to covenant violations rather than preventive measures. See Kundu (2024) for evidence that the effective costs of covenant breaches can exceed the costs of fire sales.

concentrated among borrowers whose loans trade at discounts and therefore directly erode CLO par coverage ratios.

The contrast is most pronounced in primary loan markets, as shown in columns 3 and 4. A one percentage point increase in O&G exposure is associated with a 37 basis point increase in all-in-drawn spreads for distressed firms, while non-distressed firms experience a statistically insignificant 3.4 basis point increase. This more-than-tenfold difference indicates that credit supply contractions are almost entirely concentrated among borrowers with severe credit deterioration, ruling out broad sectoral contagion and supporting the view that covenant pressure drives the strategic targeting of the riskiest borrowers. Bond credit spreads display a similar pattern in columns 5 and 6. Distressed firms experience spread widening of 113 basis points, compared with a statistically insignificant 46 basis point increase for non-distressed firms, a roughly 2.5-fold difference. The concentration of bond spread effects among distressed firms indicates that credit supply shocks propagate across the capital structure for vulnerable borrowers.

The real effects on corporate investment mirror the financial market patterns in columns 7 and 8. Although neither estimate reaches conventional significance levels, reflecting the smaller quarterly sample and greater noise in investment outcomes, the point estimates imply economically meaningful differences. Investment declines for distressed firms are nearly 2.5 times larger than for non-distressed firms at 0.70 percentage points versus 0.28 percentage points, suggesting that credit supply shocks translate into disproportionately large real effects for the most vulnerable borrowers.

Together, these findings confirm that CLOs facing covenant pressure disproportionately liquidate loans to distressed borrowers – precisely those whose loans impose the largest par haircuts. This strategic targeting of the riskiest credits has direct implications for aggregate portfolio composition, which I examine next.

6.4 Portfolio Composition: Interest Rates, Maturity, and Credit Quality

The previous section establishes that CLOs disproportionately liquidate loans to distressed borrowers when facing covenant pressure. A natural consequence is that retained portfolios should shift toward lower-risk characteristics: as CLOs shed discount obligations, CCC-rated loans, and defaulted positions, the remaining portfolio tilts toward safer credits with lower contractual spreads and longer tenors. I test this prediction by examining how loan-level characteristics within CLO portfolios change with O&G exposure.

I estimate the following specification at the loan-holding level within each CLO:

$$Y_{i,c,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure})_f + \beta_2(\text{Oil Shock})_t + \beta_3(\text{Firm O\&G Exposure}_f \times \text{Oil Shock}_t) + \alpha_{f,c} + \alpha_{l,t} + \epsilon_{i,c,t} \quad (6)$$

where $Y_{i,c,t}$ denotes the outcome variable for loan i issued by firm f and held in CLO c at time t , $\alpha_{f,c}$ are CLO-issuer fixed effects, and $\alpha_{l,t}$ are loan-type-by-month-year fixed effects.

This within CLO-issuer estimator controls for all time-invariant characteristics of the CLO-firm relationship and absorbs common shocks by loan type.

Table 12 confirms the predicted portfolio derisking. Following the oil price collapse, a one percentage point increase in a firm's O&G exposure is associated with CLOs retaining loans with interest rates that are 4 basis points lower (Column 1) and remaining maturities that are two weeks longer (Column 2). Because loan interest rates and tenor both embed lenders' risk assessments, these patterns indicate that CLOs preferentially shed riskier loans issued by more exposed firms, consistent with covenant-driven derisking.

Columns 3 and 4 examine direct measures of credit deterioration. Distressed loans include those rated CCC or worse, while defaulted loans are those reported as "defaulted" by the CLO, which can encompass payment defaults and covenant breaches.³² A one percentage point increase in firm O&G exposure is associated with a 0.18 percentage point reduction in the likelihood of holding distressed loans and a 0.14 percentage point reduction in the likelihood of holding defaulted loans, amounting to economically meaningful declines of 12–19% relative to their respective means.

Appendix Table B.12 presents complementary CLO-level evidence using the share of defaulted loans as a continuous portfolio-risk measure. The results confirm that CLOs with greater exposure to O&G-affected firms substantially reduce the share of defaulted loans in their portfolios following the shock, providing further evidence of systematic derisking.

Lastly, I find limited evidence of CLOs "gambling for resurrection" by reallocating toward the riskiest sectors; Appendix Figure B.4 shows that changes in non-O&G industry weights among high-O&G-exposed CLOs are economically trivial (≤ 0.02 percentage points for any sector).³³ This pattern supports the fire sales mechanism: CLOs reduce O&G exposure to meet covenant thresholds but do not engage in broad sectoral reallocation. The stability of non-O&G industry weights reinforces the interpretation that CLOs engage in targeted derisking following the shock.

Together, these findings show that CLO covenant structures induce active risk management as portfolios approach binding thresholds. Managers respond to covenant pressure by systematically shedding distressed loans, often selling at capital losses in order to improve par-based covenant ratios. This behavior contrasts sharply with standard fire-sale models, which predict sales of the most *liquid* assets. Instead, CLOs prioritize offloading the *riskiest* loans – those that impose the largest par haircuts, even when doing so requires accepting steep discounts.³⁴

An important consequence of this design is that fire-sale externalities become

³²Approximately 82% of loans classified by CLOs as in default have ratings of CCC or worse; non-CCC loans are concentrated in the single-B category. Only 46% of CLO-reported defaulted loans carry a formal D rating from S&P, suggesting that ratings may lag the realization of default events or rely on definitions that differ from CLO reporting.

³³Distributional tests indicate limited overall rebalancing: the Herfindahl-Hirschman Index changes from 0.0574 (pre) to 0.0566 (post), a difference of 0.0006; the Euclidean distance between pre- and post-shock distributions is 0.0292; and a Kolmogorov-Smirnov test cannot reject distributional equality ($p = 0.9598$).

³⁴This behavior parallels findings in other regulated intermediaries: Kojen and Yogo (2015) show that life insurers sold policies below actuarial fair value during the financial crisis due to leverage constraints, accepting economic losses to generate accounting profits that satisfied capital requirements.

concentrated among the most vulnerable borrowers: firms with limited alternative financing options and high sensitivity to credit supply shocks. As a result, covenant pressure triggers fire sales that further restrict credit access for already-distressed firms, generating a feedback loop that could amplify financial distress. The alignment between covenant pressure, portfolio reallocation, and the concentration of effects among distressed borrowers provides consistent evidence that fire sales in this setting are driven by contractual features rather than discretionary risk management or reassessments of fundamental credit quality – a mechanism for which I provide further evidence in the next section.

6.5 Evidence on the Covenant-Transmission Mechanism

This section provides direct evidence that covenants, rather than general risk aversion or other financial frictions, are the primary driver of cross-firm spillovers. I employ three complementary identification strategies: (1) a firm-level instrumental variables approach linking fire sales to firm outcomes; (2) a CLO-level instrumental variables approach, isolating the covenant channel; and (3) an analysis of heterogeneity by covenant distance.

6.5.1 Firm-Level Instrumental Variables: Fire Sales Cause Firm Distress

To formalize the causal chain from O&G exposure to firm outcomes, I employ a two-stage least squares approach. The first stage relates firm O&G exposure to the intensity of loan liquidations, measured as net loan sales scaled by lagged CLO holdings. The second stage estimates how these liquidations affect financing costs and real activity. The identifying assumption is that firm O&G exposure affects non-O&G firms only through its impact on CLO loan liquidations, and not through correlated demand shocks, sectoral spillovers, or other confounding channels.

Panel A of Table 13 presents the first-stage relationship between O&G exposure and loan liquidation intensity. A one percentage point increase in a firm's O&G exposure raises post-shock net loan sales by 4 percentage points of lagged holdings. The Kleibergen–Paap F-statistics range from 19.88 to 24.05 across specifications with progressively saturated fixed effects, confirming instrument strength well above conventional thresholds. This robust first-stage relationship indicates that greater CLO O&G exposure leads to systematically larger liquidations of non-O&G portfolio firms.

Panel B reports second-stage estimates of how liquidations affect firm outcomes. The coefficient on instrumented net loan sales captures the causal impact of CLO liquidation pressure on financing costs and real activity. A one percentage point increase in net loan sales reduces secondary loan prices by 17 basis points per \$100 of par value.³⁵ The same increase raises all-in-drawn spreads on newly issued term loans by 2.88 basis points and

³⁵To facilitate comparison with the baseline reduced-form results, I note that the IV estimates imply similar overall magnitudes. For example, the reduced-form estimate shows that a one percentage point increase in O&G exposure reduces secondary loan prices by approximately \$1.00–\$2.70 per \$100 par (Table 4). The IV first stage shows that this same O&G exposure increase generates approximately 4 percentage points of additional net loan sales. Multiplying the IV second-stage coefficient (–0.17) by 4 yields an implied reduced-form effect of approximately \$0.68 – of similar magnitude to the direct reduced-form estimates, confirming internal consistency.

widens bond credit spreads by 7.71 basis points. Importantly, increased liquidation pressure also has real effects: a one-percentage-point increase in net loan sales reduces firm investment in the following quarter by 0.08 percentage points, approximately 5% of the sample mean, where investment is measured as the investment-capital ratio – see Appendix Section C for details.

The following identification tests in this section demonstrate that these liquidations are driven specifically by covenants rather than alternative mechanisms such as general risk aversion or discretionary portfolio rebalancing.

6.5.2 CLO-Level Instrumental Variables: Covenant Pressure Drives Liquidations

To provide direct evidence that covenants drive the liquidation behavior documented above, I examine how covenant pressure affects CLO portfolio decisions using deal-level data. If covenant mechanics are the operative channel, then O&G-induced covenant tightening should cause CLOs to systematically reduce their holdings of non-O&G firms.

Appendix Table B.13 reports the results using CLO holdings aggregated to the deal-issuer-month level during 2013-2015, excluding all O&G sector firms.³⁶ The first stage regresses the natural log of the ID test ratio, which measures distance to the interest diversion covenant threshold, on the interaction between a CLO's pre-shock O&G share and the post-shock indicator. The negative coefficient indicates that higher O&G exposure leads to tighter covenants following the shock.

The second stage estimates in columns 2-4 show that tighter covenant distance causes large reductions in CLO holdings of non-O&G firms. A one percent reduction in covenant distance causes holdings to decline by 10-19%. These large elasticities demonstrate that covenant pressure creates strong incentives for portfolio adjustments. When covenant thresholds tighten, CLOs mechanically reduce exposures to meet compliance requirements, regardless of borrower fundamentals or managerial discretion.

This CLO-level evidence complements the firm-level instrumental variables by confirming that the mechanism operates through covenants rather than alternative channels. The large magnitude of the elasticities validates that even modest covenant deterioration generates economically meaningful portfolio liquidations.

6.5.3 Heterogeneity by Covenant Distance and CLO Dependence

If covenants drive fire sales, the spillover effects should concentrate among firms most exposed to covenant pressure through two channels: (1) borrowing from CLOs operating near covenant thresholds, and (2) relying heavily on CLOs for financing with limited access to alternative credit sources. I test both predictions using triple-interaction specifications.

³⁶The outcome variable is log holdings rather than net sales (as in the firm-level IV) because the CLO-issuer-month panel structure is better suited to capturing cumulative portfolio adjustments. Log holdings measure the stock of CLO positions, while net sales measure the flow; both capture the same underlying liquidation behavior but at different levels of aggregation. The firm-level IV uses net sales because it aggregates across all CLOs to the firm level, where flow measures more directly capture fire sale intensity experienced by each borrower.

Covenant Distance Heterogeneity If covenants drive liquidation behavior, spillover effects should concentrate among firms borrowing from CLOs operating near covenant thresholds. I test this prediction by examining whether the relationship between O&G exposure and firm outcomes varies with pre-shock covenant distance, measured as of May 2014 prior to the oil price collapse.

Figure 10 compares effects for firms borrowing from CLOs with tight versus loose pre-shock covenants, defined as below versus above median covenant distance. The figure plots coefficients from split-sample regressions across three outcomes: transaction volumes, secondary loan prices, and investment rates. Effects are consistently two to five times larger for firms whose CLO lenders had tight covenant buffers entering the shock, demonstrating that covenant proximity amplifies spillovers.

Panel A shows transaction volume effects: identical O&G exposure leads to larger liquidations for firms linked to covenant-constrained CLOs. Panel B presents secondary loan price effects. Firms borrowing from CLOs with ample covenant slack experience minimal price impact, while firms facing tight covenants experience price declines of approximately \$0.65 per \$100 par for each percentage point increase in O&G exposure. This differential pricing response demonstrates that covenant pressure generates fire sale discounts beyond what orderly portfolio rebalancing would produce. Panel C examines investment: firms facing tight covenants experience investment declines of 0.88 percentage points compared to 0.20 percentage points for firms with looser constraints. This nearly-fivefold amplification highlights covenant proximity as the key mechanism linking CLO distress to real economic outcomes: firms borrowing from CLOs with covenant slack face modest portfolio adjustments, whereas firms tied to covenant-constrained CLOs experience credit supply shocks severe enough to curtail investment.³⁷

CLO Dependence Heterogeneity Complementing the covenant distance analysis, I examine whether the effects scale with firm dependence on CLO financing. Firms that rely heavily on CLOs for credit should be more vulnerable to covenant-driven fire sales, while firms with diversified funding sources should be relatively insulated. I measure CLO dependence as the share of a firm's institutional term loans held in CLO portfolios.

Appendix Table B.15 establishes the baseline relationship between O&G exposure and changes in CLO holdings. Firms with a one percentage point higher O&G exposure experience CLO holdings reductions of 3.2-3.7% after the shock. Appendix Table B.16 further examines how these effects vary with firm CLO dependence using triple-interaction estimates. The coefficient on the three-way interaction between CLO dependence, O&G exposure, and the post indicator is negative and statistically significant, indicating that effects intensify for firms more dependent on CLO financing. The negative sign confirms the intuitive prediction: as CLO dependence increases, the same O&G shock generates larger impacts on firm outcomes.

Figure 11 visualizes this monotonic relationship by plotting the marginal effect of O&G exposure on holdings at different levels of standardized CLO dependence. The relationship

³⁷Appendix Table B.14 presents the formal split-sample regression estimates underlying Figure 10.

monotonically increases in magnitude: at mean CLO dependence, the marginal effect is approximately zero, indicating minimal selling pressure for firms with average reliance on CLOs. At one standard deviation above mean dependence, the marginal effect becomes economically meaningful. At two standard deviations above mean dependence, the marginal effect reaches -5.85, indicating that a one percentage point increase in O&G exposure leads to an almost 6% reduction in CLO holdings for highly dependent firms.

This monotonic scaling pattern validates that covenant-driven fire sales from CLOs, not general market stress or correlated demand shocks, are the source of cross-firm spillovers. If the mechanism operated through broader financial market disruption, effects would not necessarily vary systematically with the specific share of debt held by CLOs. Firms with limited reliance on CLO financing experience minimal spillovers, even when their CLO lenders have substantial O&G exposure. Firms heavily dependent on CLOs bear severe fire sale pressure, precisely because they lack alternative funding sources when CLOs engage in forced liquidation.

6.5.4 The 7.5% CCC Threshold

CLO covenant structures feature a contractual discontinuity at 7.5% CCC-or-worse holdings. Loans rated CCC or worse that cause a CLO to exceed this threshold are marked at market value, starting with the lowest-priced loans, rather than par for covenant calculations, mechanically reducing par coverage. This mark-to-market requirement creates particularly strong incentives for sales among CLOs near or above the threshold, as shedding CCC-rated loans both reduces the CCC share and improves par coverage simultaneously.

Appendix Table B.17 demonstrates that firms with greater exposure to threshold-constrained CLOs experience significantly larger transaction volumes and steeper price declines. The table presents four alternative measures of firm exposure to the 7.5% threshold, each capturing a different dimension of how firms are connected to CLOs facing covenant pressure. Column 1 restricts the O&G exposure measure to come only from CLOs with CCC share at or above 7.5%, isolating variation from threshold-constrained lenders. Column 2 uses the firm's weighted average distance from the threshold, measured continuously. Column 3 measures excess CCC holdings above the 7.5% threshold. Column 4 uses the share of firm debt held by CLOs above the threshold.

All four measures show statistically significant effects on both sales volumes (Panel A) and prices (Panel B), with effect sizes that are economically meaningful and consistent across specifications. The robustness across multiple threshold-based exposure measures provides initial evidence that the 7.5% CCC covenant creates a binding constraint that influences trading activity and pricing.

7 Robustness

The preceding analysis provides multiple sources of identification for covenant-driven spillovers: IV estimates using exogenous O&G exposure, heterogeneity by covenant distance,

and discontinuity at the 7.5% threshold. This section presents additional robustness tests that address: (1) whether effects reflect borrower demand shocks or bank constraints rather than CLO supply, (2) whether results are driven by omitted firm or market characteristics, (3) whether findings are sensitive to alternative measures of CLO exposure, (4) whether the choice of shock timing affects the estimated spillovers, and (5) whether the documented patterns generalize beyond the 2014-2015 oil price collapse to other episodes of CLO stress.

Falsification Tests: Loan Types Not Subject to CLO Covenants If covenants drive the documented effects, they should operate specifically through institutional term loans held by CLOs, not through other loan types that do not enter covenant calculations or are not held by CLOs. I test this prediction using revolving credit facilities and term loan A facilities, which are typically held by banks rather than CLOs and do not factor into CLO covenant tests.

Appendix Tables B.18 and B.19 present falsification tests examining all-in-drawn spreads for revolving credit facilities and term loan A facilities, and undrawn spreads on revolving facilities. Across all specifications, I find no statistically or economically significant effects of O&G exposure on these loan types. The null results rule out demand-side explanations: if firms with high CLO O&G exposure experience fundamental deterioration or reduced credit demand, we would observe effects across all loan types. Instead, effects concentrate precisely on institutional term loans subject to CLO covenant pressure, confirming that the mechanism operates through covenant-driven supply shocks rather than broader changes in firm creditworthiness or bank lending constraints.

Placebo Tests: Randomization Inference To address concerns about omitted variable bias and spurious correlation, I conduct Monte Carlo placebo tests. I randomly reassign O&G exposure across firms, and re-estimate all main specifications 1,000 times. If the documented effects merely reflect spurious correlation with unobserved firm characteristics, the placebo estimates should produce similar magnitudes and significance levels as the true estimates.

Appendix Figure B.5 presents the distribution of placebo coefficients for seven key outcomes: CLO covenant distance, transaction amounts, secondary loan prices, all-in-drawn spreads, bond credit spreads, credit line drawdowns, and investment. Across all outcomes, the true point estimates lie far outside the simulated placebo distributions. The mean placebo coefficients cluster tightly around zero with t-statistics below conventional significance thresholds. These patterns confirm that the documented effects cannot be explained by omitted variables or chance correlation between O&G exposure and firm outcomes.

Alternative Exposure Measures A potential concern is that the baseline value-weighted exposure measure could be sensitive to the weighting scheme or aggregation method. To verify robustness, I construct four alternative measures of firm O&G exposure: log-weighted averages that reduce the influence of large positions, equal-weighted averages across CLO lenders regardless of position size, count-weighted averages based on the number of loans

rather than dollar volume, and binary exposure indicators that test whether mere connection to O&G-stressed CLOs generates effects.

Appendix Table B.20 shows that these alternative measures exhibit correlations exceeding 0.95 with the baseline measure, indicating minimal sensitivity to weighting choices. Appendix Table B.21 presents regression results using each alternative measure. All five specifications, including the baseline volume-weighted measure in column 1, produce qualitatively similar and statistically significant estimates across outcome variables, with the baseline volume-weighted specification producing the most conservative estimates. These results confirm that the documented spillovers are robust to exposure measurement and do not depend on specific aggregation choices.

Continuous Oil Price Variation The main analysis uses a binary indicator for the post-June 2014 period to define the shock. To verify that results are not sensitive to this specification, I replace the binary shock variable with continuous oil price levels, allowing the treatment intensity to vary smoothly over time.

Appendix Table B.22 presents regression results using log oil prices as the continuous treatment variable. The estimates confirm the main findings: when oil prices are high, firms with greater CLO O&G exposure experience higher net CLO purchases and better financing terms; when oil prices fall, the relationship reverses. Appendix Figure B.6 plots the marginal effects of O&G exposure on key outcomes across different oil price levels. The relationship varies smoothly and monotonically with oil prices, exhibiting no discrete jumps at arbitrary thresholds. This validates the June 2014 binary specification as capturing a genuine structural break rather than an arbitrary sample division.

Moreover, the marginal effects scale with the severity of oil market stress. During the most severe oil price declines, the 2014-2015 collapse and the COVID-19 crash, during which prices briefly turned negative, marginal effects reach their most negative values, indicating intensified fire sale pressure. This proportional transmission demonstrates that the covenant mechanism operates continuously across varying levels of market stress, with effects amplifying during acute distress periods.

Together, these robustness tests confirm that covenants, rather than alternative channels such as firm fundamentals, bank constraints, omitted variables, or specification choices, drive the documented cross-firm spillovers. The consistency of results across falsification tests, placebo tests, alternative exposure measures, and continuous treatment specifications strengthens confidence in the causal interpretation of covenant-driven fire sales as the primary transmission mechanism.

External Validity: Amplified Effects During Market Stress The baseline analysis focuses on the 2014-2015 oil price shock, a period of relatively benign macroeconomic conditions characterized by accommodative monetary policy and generally liquid credit markets. While this tranquil setting aids identification by isolating covenant-driven spillovers from broader

market disruptions, it raises the question of whether the effects amplify during periods of acute financial stress when credit channels are impaired and arbitrage capacity is limited.

To assess external validity, I replicate the analysis during the COVID-19 pandemic, which featured one of the most severe and rapid declines in asset prices across multiple sectors. The pandemic provides a natural setting to assess whether CLO covenant pressures create larger spillovers during periods of widespread market dislocation. Following [Foley-Fisher, Gorton and Verani \(2020\)](#), I focus on the price effects from January 1 to May 6, 2020, before the structural break in AAA-rated CLO prices associated with Federal Reserve interventions.³⁸ The post variable equals one after March 1, 2020.

Given the widespread nature of COVID-19's economic effects, identification in this setting is more challenging than in the O&G shock. To address this, I treat COVID-19 as generating industry-specific shocks, analogous to the original O&G analysis. I construct firm exposure measures based on CLO holdings in vulnerable industries such as O&G and retail, which experienced the most severe stress during the early pandemic period.³⁹ Appendix Table [B.23](#) validates the first stage, confirming that CLO exposure to these vulnerable industries significantly reduces covenant distance during the pandemic period.

Appendix Table [B.24](#) presents the main results. The estimates show that a one percentage point increase in CLO exposure to vulnerable industries is associated with secondary loan price declines ranging from \$0.77 to \$3.95 per \$100 of par after the shock. These magnitudes are substantially larger than the baseline 2014 estimates, with price effects amplified by up to a factor of four relative to the oil shock period.⁴⁰ The larger effects during COVID-19 are consistent with fire sales being particularly costly when alternative credit sources contract simultaneously and market liquidity deteriorates broadly. During the relatively tranquil 2014 period, firms could more easily substitute toward other lenders or tap bond markets to offset CLO withdrawals. During the pandemic, these alternative channels were themselves impaired, forcing firms to bear the impact of CLO fire sales without offsetting adjustments.

This amplification pattern has important implications for understanding the systemic consequences of CLO covenant structures. The baseline estimates, while economically meaningful, may represent a lower bound on effects during periods of genuine financial stress. When covenant-driven fire sales coincide with broader market dislocation, precisely the conditions under which covenant violations are most likely, the spillovers to firm financing and investment can be substantially magnified. The consistency of the mechanism across two distinct shocks, combined with the amplification during stress periods, suggests that covenant-driven fire sales represent a general and potentially procyclical transmission channel in leveraged loan markets.

³⁸[Foley-Fisher, Gorton and Verani \(2020\)](#) document a structural break in AAA-rated CLO price volatility after May 6, 2020, coinciding with announcements of the Primary and Secondary Market Corporate Credit Facilities and modifications to the Liquidity Coverage Ratio and Supplementary Leverage Ratio.

³⁹Industry classifications follow [Moody's 35 Industry Categories](#).

⁴⁰The coefficient in column 5 of Appendix Table [B.24](#) is more than four times as large as the corresponding estimate in column 6 of Table [4](#).

8 Macroeconomic Importance: Back-of-the-Envelope Calculations

This section provides back-of-the-envelope calculations to assess the macroeconomic relevance of covenant-driven fire sales during the 2014–2015 oil price collapse. Because the empirical strategy exploits cross-sectional variation in CLO exposure, the estimates identify *relative* effects, which the calculations below translate into economically interpretable magnitudes by evaluating them at the observed distribution of exposure in the data. The aggregate movements over the episode provide the benchmark: leveraged loan yields rose 22 basis points on average, from 5.05% to 5.27%, with B-rated yields rising 64 basis points from 5.13% to 5.77%, and quarterly investment among non-O&G firms fell from 1.89% to 1.42% of lagged capital, a 0.47 percentage point decline.

Loan Yield Tightening As shown in Table 5, a one percentage point increase in firm O&G exposure raises new-term-loan spreads by 15–20 basis points. Evaluated at the sample mean exposure of 1.85%, this implies a 28–37 basis point spread increase. At the 75th percentile of exposure of 2.84%, this implies a 42–57 basis point spread increase. In the single-B segment where CLOs concentrate their holdings, the implied 30 basis point spread increase at typical exposure levels corresponds to roughly half of the 64 basis point rise in average single-B loan yields during the episode.

Investment Declines Table 8 shows that a one percentage point increase in firm O&G exposure reduces quarterly investment by 0.32 percentage points. The instrumental-variable counterpart, reported in Panel B of Table 13, implies that a one percentage point increase in covenant-driven net loan sales reduces quarterly investment by 0.08 percentage points, approximately 5% of mean quarterly investment. Applied to the interquartile range of exposure of 2.52 pp, the baseline estimate yields a 0.81 percentage point investment differential between firms at the 75th and 25th percentiles of exposure, a dispersion larger than the 0.47 percentage point aggregate investment decline itself. While not a decomposition of the aggregate movement, this pattern is consistent with credit reallocation across firms driven by differential covenant pressure on their CLO lenders.

Because the empirical strategy exploits cross-sectional variation, these magnitudes reflect *relative* rather than *absolute* effects. Following Chodorow-Reich (2014), relative and absolute effects are likely to be similar in this setting; CLOs hold largely overlapping portfolios, with roughly 90% exposed to at least one of the top 50 borrowers, the specialized investor base limits substitution to outside lenders, and Figure 6 shows that the shock affected CLOs broadly. These features limit the scope for capital released by constrained CLOs to flow to borrowers of unconstrained CLOs.

Taken together, the results indicate that CLO covenant pressure plays a quantitatively important role in transmitting sectoral shocks through credit supply and into real activity, particularly among firms with limited access to alternative financing. The heterogeneity analysis in Section 5.4.3 shows that effects concentrate among financially constrained firms and firms borrowing from covenant-constrained CLOs, so vulnerable borrowers experience

substantially larger disruptions than the average. Moreover, the 2014–2015 episode is a conservative setting: the external validity analysis using the COVID-19 shock in Section 7 shows that covenant pressure generates substantially larger effects during periods of acute financial disruption, implying that the baseline estimates understate the macroeconomic relevance of covenant-driven fire sales during systemic crises.

9 Conclusion

This paper demonstrates that covenants embedded in financial intermediary contracts can trigger fire sales and propagate sectoral shocks to unrelated borrowers, providing empirical evidence of a novel channel through which contractual features intended to mitigate agency conflicts generate systemic externalities. Using the CLO setting and exploiting the June 2014 O&G price collapse, I show that covenants incentivize CLO managers to engage in contractual arbitrage by strategically selling the loans that are most penalized under par-based covenant calculations. This liquidation strategy deviates fundamentally from traditional fire-sale models, which predict sales of the most liquid or riskiest assets, and instead targets specific holdings determined by discontinuous covenant calculation rules.

The empirical analysis establishes a causal chain from covenant pressure to real economic effects. Following the O&G price shock, CLOs with greater sectoral exposure face tighter covenants and systematically liquidate loans to unrelated firms. These fire sales generate substantial price pressure in secondary loan markets, pass through to primary loan spreads and corporate bond markets, and ultimately constrain firms' ability to invest, hire, and grow. Multiple identification strategies, including instrumental variables approaches, heterogeneity analyses based on borrower and CLO characteristics, alternate measures of covenant constraint using the 7.5% CCC threshold, and falsification tests indicate that covenant mechanics, rather than general risk aversion or broader market conditions, drive these spillovers.

These findings have important implications for understanding systemic risk in market-based finance. First, they challenge the prevailing view that closed-end structures such as CLOs inherently mitigate fire-sale risks by insulating intermediaries from investor redemptions. While stable funding eliminates run-driven liquidations, covenant requirements designed to address agency conflicts within the closed-end structure may inadvertently amplify fire-sale risk and increase social costs in general equilibrium. The mechanism operates not through funding instability but through contractual constraints that induce portfolio adjustments, converting sectoral shocks into broader financial dislocations.

Second, the results demonstrate that fire sales can arise *because* of state contingency rather than despite it. Traditional models attribute fire sales to incomplete contracting or limited state-contingent features. However, covenants that incorporate richer state-contingent provisions, by adjusting required actions based on portfolio quality, can generate stronger liquidation pressures than simpler contractual structures. This finding suggests that optimal

contract design requires accounting for general equilibrium externalities, not merely partial equilibrium agency considerations.

Third, the concentration of effects among financially constrained and distressed borrowers highlights how intermediary contractual design shapes the incidence of credit supply shocks. Covenant mechanics target specific loan characteristics for liquidation, systematically directing fire-sale pressure toward vulnerable borrowers least able to substitute to alternative financing. This targeting amplifies real economic disruptions beyond what aggregate exposure measures would predict, as spillovers concentrate precisely where they impose the greatest costs.

These insights extend beyond CLOs to other forms of structured finance and market-based credit intermediation. Private credit funds, direct lending vehicles, and collateralized loan structures increasingly rely on covenant-based protections for investors. As these markets grow, understanding how contractual constraints propagate shocks becomes essential for assessing systemic vulnerabilities. The proliferation of automated covenant enforcement through smart contracts and blockchain-based lending platforms further magnifies these risks, as mechanical triggers could generate cascading liquidations during stress periods with limited scope for human judgment or regulatory forbearance.

Several questions remain for future research. First, what is the optimal design of intermediary covenants that balances agency cost mitigation against fire-sale externalities? The tension between protecting investors through strict covenant enforcement and minimizing spillovers to unrelated borrowers suggests scope for contract innovation or regulatory guidance. Second, how do covenant structures interact with other regulatory constraints, such as bank capital requirements, mutual fund liquidity rules, or insurance reserve regulations to shape aggregate credit supply dynamics? Third, can macroprudential policies effectively address covenant-driven spillovers without undermining the agency-conflict-mitigation benefits that justify covenant adoption?

Taken together, these questions stress a central implication of this paper: contractual covenants faced by financial intermediaries should not be viewed solely in partial equilibrium, as they generate broader general equilibrium effects through capital markets. The joint consideration of fund organizational structure, contractual design, and welfare, accounting for both agency cost mitigation and fire-sale externalities, remains an important avenue for deepening our understanding of covenants as simultaneously a source of systemic amplification and a necessary feature supporting stable long-term funding structures.

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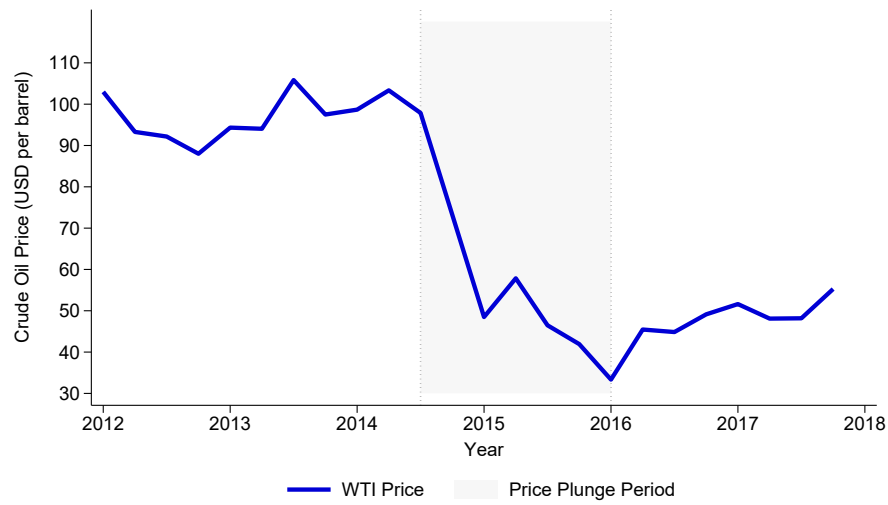
10 Figures and Tables

Figure 2: Thought Experiment: Network Effects of Constraints



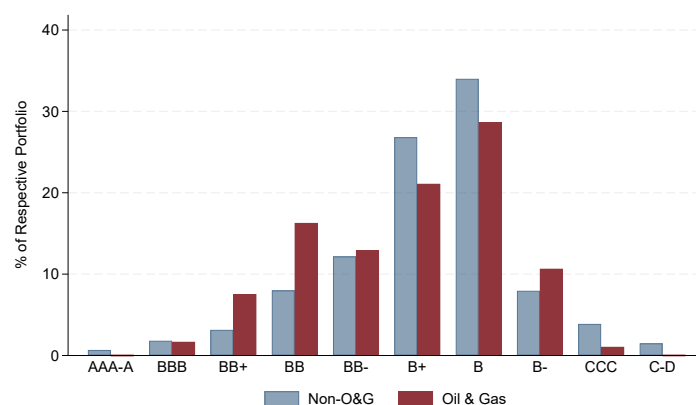
Notes: The figure depicts the identification strategy. The center circle represents a CLO, outer circles represent borrowing entities in the CLO's portfolio, and spokes indicate loan relationships. CLO A and CLO B hold portfolios drawn from the same distribution of loans; the portfolios differ only in that CLO B has concentrated exposure to a single issuer, while CLO A has no exposure to that issuer. Panel A shows CLO A (unconstrained), where all portfolio entities are performing (teal). Panel B shows CLO B (constrained), where the CLO becomes covenant-constrained (red center) following default by the concentrated-exposure entity (red). The yellow node represents a comparable borrower ("innocent bystander") unaffected by the original shock and held by both CLOs. The empirical strategy exploits variation in covenant tightening across these two otherwise-similar CLOs to estimate effects on the comparable borrowers in their portfolios.

Figure 3: Quarterly Crude Oil Price

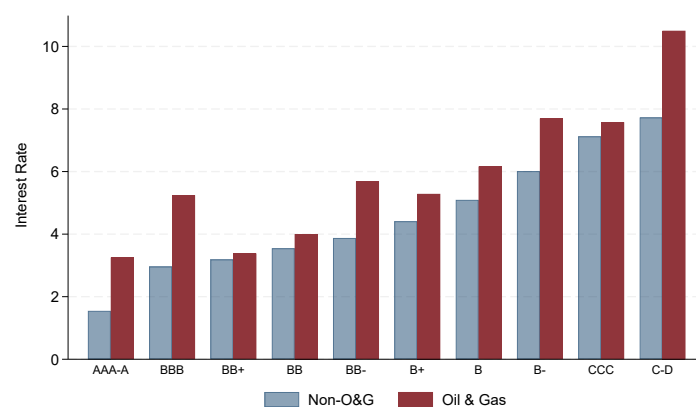


Notes: The figure presents the quarterly crude oil price from 2012 through 2017. The price is reported as the quarterly average \$ per barrel of crude oil (WTI). The x-axis reports the year. The y-axis reports the price. The shaded area indicates the price plunge period. Source: FRED, U.S. Energy Information Administration.

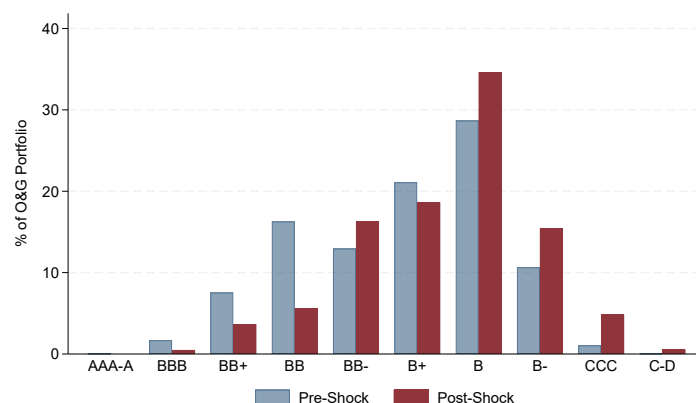
Figure 4: Loan Characteristics Around O&G Shock



(a) Portfolio Rating Distribution



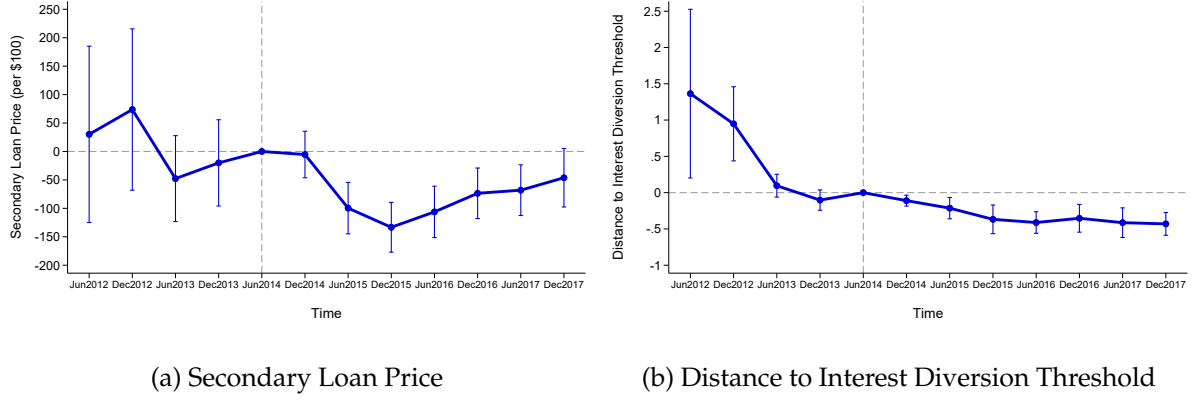
(b) Interest Rates by Rating



(c) O&G Rating Migration (Pre vs Post)

Notes: The figure compares loan characteristics for O&G and non-O&G borrowers. All panels use S&P loan ratings on the x-axis. Figure 4a compares the rating composition of O&G (red) and non-O&G (blue) loan portfolios in the pre-shock period. The y-axis shows the percentage of each portfolio in each rating category. Figure 4b compares the interest rates between O&G (red) and non-O&G (blue) loans by rating category in the pre-shock period. The y-axis shows interest rates (percentage points). Figure 4c compares the rating distribution of O&G loans before and after the oil price collapse. The y-axis shows the percentage of the O&G portfolio in each rating category.

Figure 5: Secondary Loan Price and Distance to Covenant Threshold Around O&G Shock



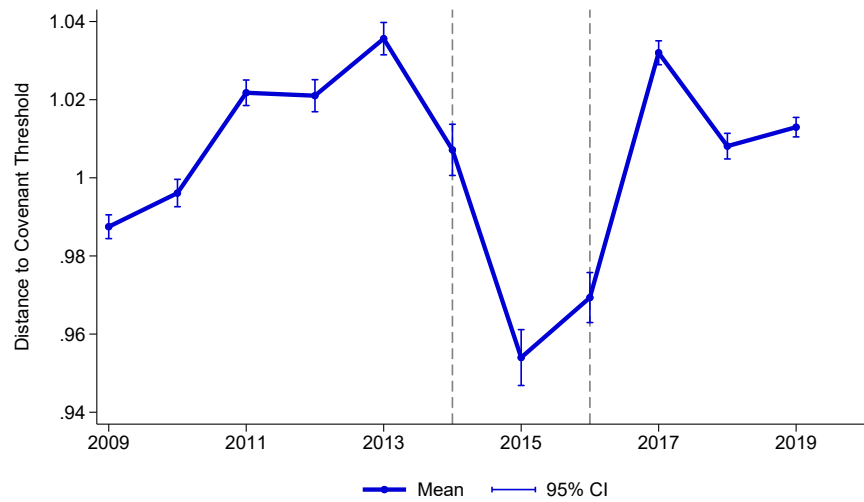
Notes: The figures present event-study estimates. The baseline specifications of Figures 5a and 5b take the following respective forms:

$$P_{i,f,t} = \sum_{\substack{\tau=\text{Jun } 2012 \\ \tau \neq \text{Jun } 2014}}^{\text{Dec } 2017} \beta_{\tau} \mathbb{1}_{t \in \tau} \times (\text{Firm O\&G Exposure})_f + \sum_{\substack{\tau=\text{Jun } 2012 \\ \tau \neq \text{Jun } 2014}}^{\text{Dec } 2017} \delta_{\tau} \mathbb{1}_{t \in \tau} + \alpha_{f,s} + \alpha_{m,y} + \epsilon_{i,f,t}$$

$$ID_{c,t} = \sum_{\substack{\tau=\text{Jun } 2012 \\ \tau \neq \text{Jun } 2014}}^{\text{Dec } 2017} \beta_{\tau} \mathbb{1}_{t \in \tau} \times (\text{CLO O\&G Exposure})_c + \sum_{\substack{\tau=\text{Jun } 2012 \\ \tau \neq \text{Jun } 2014}}^{\text{Dec } 2017} \delta_{\tau} \mathbb{1}_{t \in \tau} + \theta_1 \text{CLO O\&G Exposure}_c + \theta_2 X_{c,t} + \alpha_m + \alpha_{m,y} + \epsilon_{c,t}$$

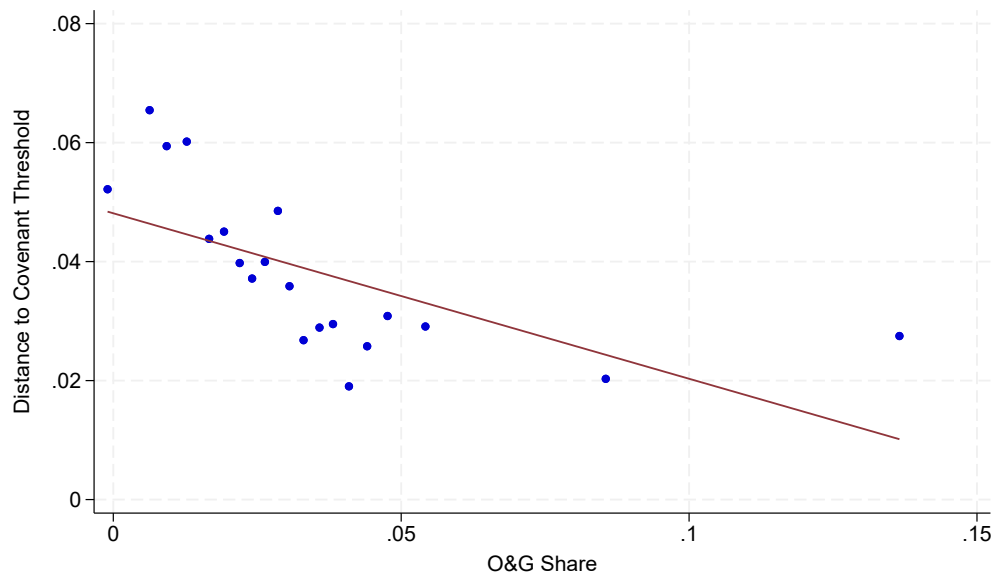
where $P_{i,f,t}$ is the secondary loan price (per \$100), $ID_{c,t}$ is the minimum distance to the Interest Diversion threshold ($\ln(\frac{\text{Covenant Result}}{\text{Current Threshold}})$), c denotes the CLO, m denotes the manager, i denotes the loan, f denotes the (non-O&G) portfolio firm or issuer ($f \in c$), t indexes the date, s denotes the transaction type (sale/purchase), y denotes the year, and $X_{c,t}$ consists of CLO age, size, share of CCC-rated loans, and share of defaulted loans. Firm O&G Exposure _{f} measures the value-weighted average O&G share across all CLOs holding firm f 's debt before the shock occurs. CLO O&G Exposure _{c} is the O&G share of CLO c before the shock occurs. $\mathbb{1}_{t \in \tau}$ indicates observations falling within six-month period τ , where τ indexes six-month intervals from June 2012 through December 2017. Coefficients are normalized relative to June 2014 (omitted). Standard errors are two-way clustered by CLO $\times$ issuer and trade date in Figure 5a and by CLO and month-year in Figure 5b.

Figure 6: Time Series of Distance to Covenant Threshold (2009-2019)



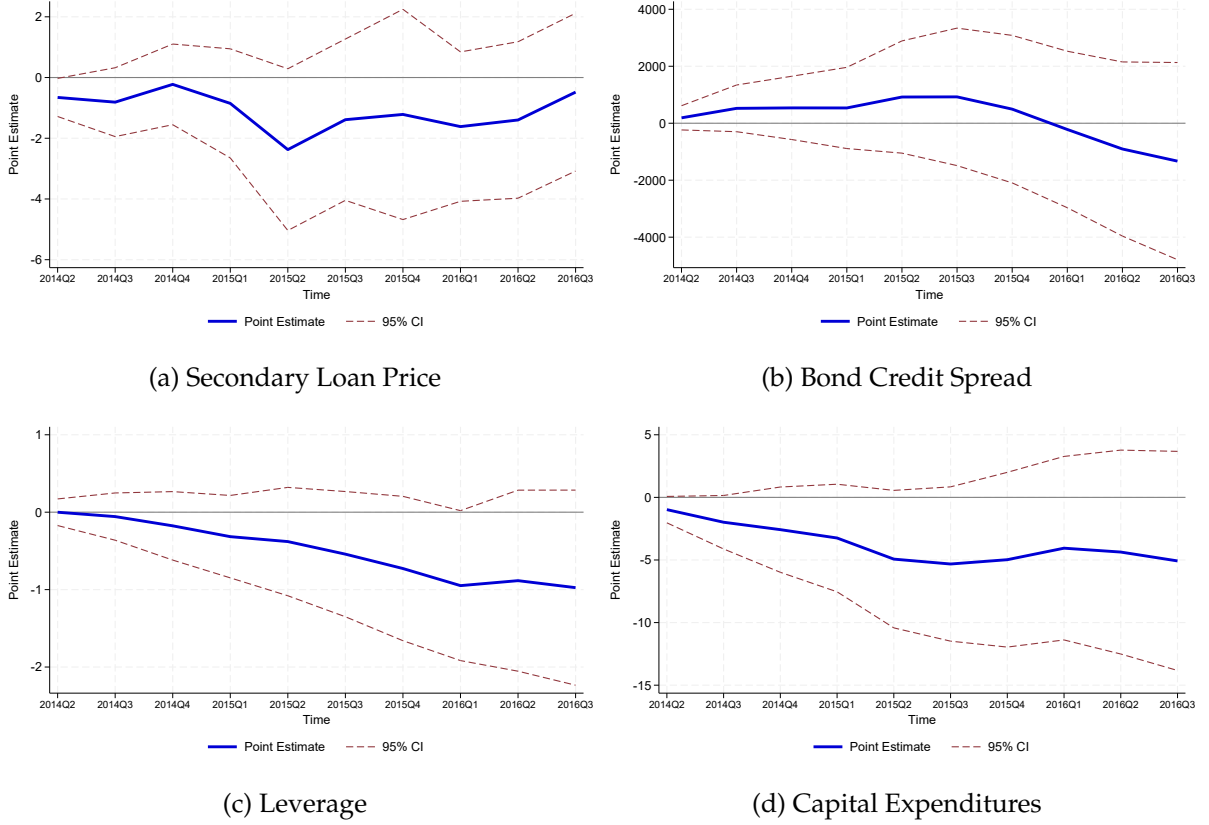
Notes: The figure displays the evolution of CLO covenant distance from 2009 through 2019. The distance to the covenant threshold is calculated as the minimum ratio of each par-based test result to its corresponding covenant threshold across all par-based covenants for a given CLO. Values above 1.0 indicate covenant compliance; values below 1.0 indicate covenant violation. The figure presents the mean distance across CLOs along with the 95% confidence interval. The vertical dashed lines indicate the timing of the O&G price plunge.

Figure 7: O&G Exposure and CLO Covenant Distance



Notes: This figure presents a binscatter plot of the distance to the covenant threshold against CLO O&G exposure after the O&G shock, controlling for month-year fixed effects. Each point represents a bin of CLOs grouped by O&G exposure levels. The distance to the covenant threshold is measured as $\ln(\text{Test Result}/\text{Covenant Threshold})$. The sample includes all CLOs in the aftermath of the O&G shock.

Figure 8: Dynamic Responses to O&G Shock: Local Projections

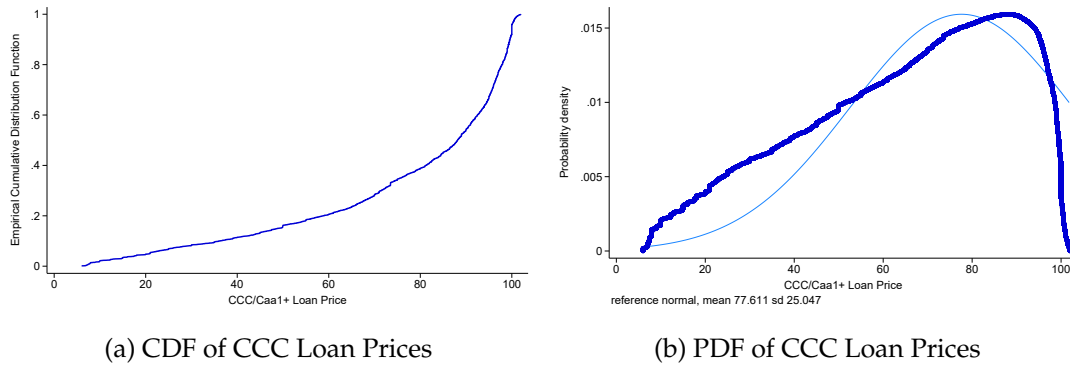


Notes: The figure displays impulse response functions estimated via local projections. For each horizon $h = 0, 1, \dots, 9$ quarters, I estimate:

$$Y_{f,i,t+h} - Y_{f,i,t-1} = \beta_1(h)(\text{O\&G Exposure}_f \times \text{Post}_t) + \alpha_i + \alpha_t + \epsilon_{f,i,t,h}$$

where $Y_{f,i,t}$ denotes the outcome for firm f , instrument type i , at time t , α_i are issuer-type fixed effects, and α_t are quarter-year fixed effects. The coefficient $\beta_1(h)$ measures the cumulative effect of a one percentage point increase in firm O&G exposure on the change in outcome from $t - 1$ to $t + h$, comparing post-shock to pre-shock periods. Figure 8a uses log secondary loan prices. Figure 8b uses bond credit spreads. Figures 8c and 8d use leverage and log capital expenditures. O&G Exposure is measured as of May 2014 (pre-shock). Post equals one after June 2014. Shaded areas represent 95% confidence intervals. Standard errors are clustered by issuer.

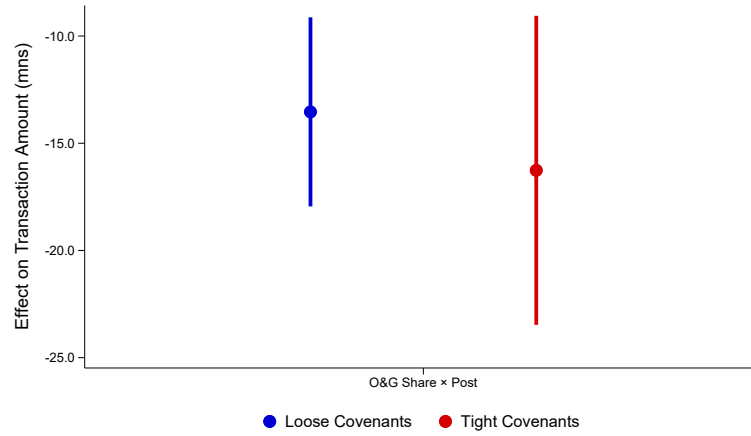
Figure 9: Distributions of CCC Loan Prices



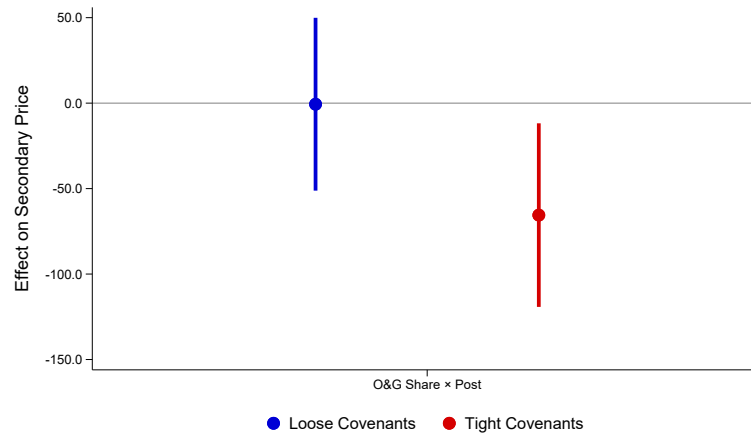
	N	p25	p50	p75	Mean	Std. Dev.
CLO Min. CCC Price	7,436	34.7500	62.8850	87.8300	59.5011	29.3152
CCC Loan Price	57,938	66.7270	88.1500	96.7080	77.6113	25.0472

Notes: The figure presents the cumulative distribution function (CDF) and probability density function (PDF) of CCC loan prices. CCC refer to loans that have a rating of CCC or below. Figure 9a presents the CDF of CCC loan prices. Figure 9b presents the PDF of CCC loan prices. The table reports (1) the distribution of the lowest-priced CCC loan held by each CLO in each month and (2) the overall distribution of CCC loan prices.

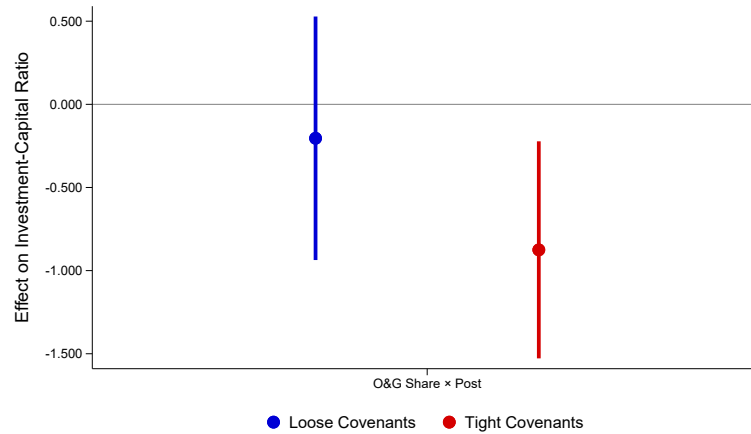
Figure 10: Covenant Distance Heterogeneity: Fire Sale Spillovers Across Outcomes



(a) Transaction Volume



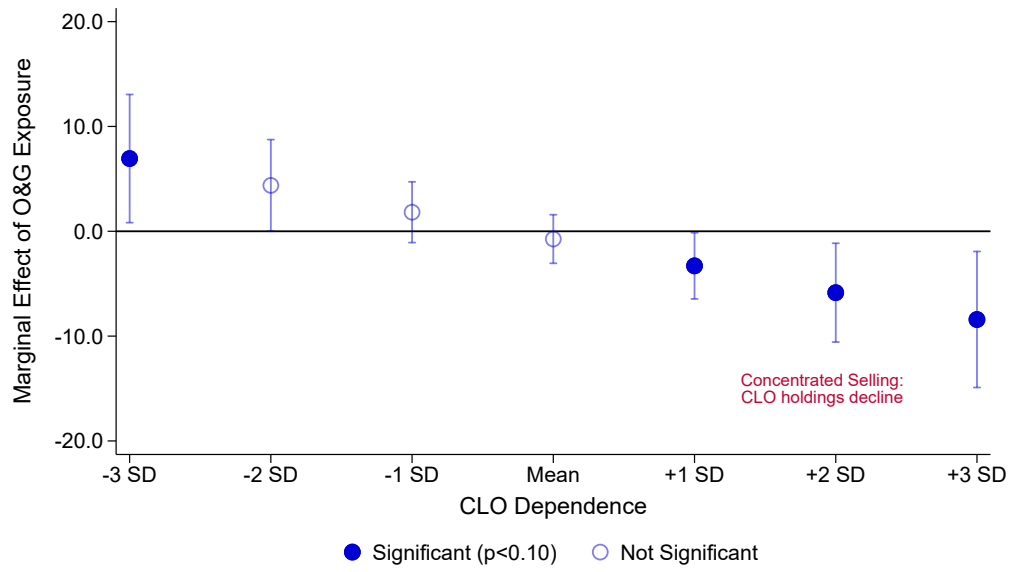
(b) Secondary Loan Prices



(c) Firm Investment

Notes: This figure presents split-sample estimates of fire sale spillover effects by covenant distance. For each outcome, I compare firms borrowing from CLOs with covenant distance below (Tight Covenants) versus above (Loose Covenants) the median. Covenant Distance is the firm's pre-shock weighted average distance from covenant thresholds across CLO lenders, measured as the difference between a CLO's actual covenant ratios and its covenant limits. The figure plots the coefficient on $O\&G\ Share \times Post$ from specifications that include issuer $\times$ loan-type and month-year fixed effects in Figures 10a and 10b, and firm and quarter-year fixed effects in Figure 10c. Point estimates are shown with 90% confidence intervals. Standard errors are clustered by CLO $\times$ issuer and date in Figures 10a and 10b and by firm in Figure 10c. The underlying regression estimates are reported in Appendix Table B.14.

Figure 11: Marginal Effect of O&G Exposure by Firm CLO Dependence



Notes: This figure plots the marginal effect of firm O&G exposure on changes in CLO holdings, conditional on firm CLO dependence. CLO dependence is measured as the share of a firm's total institutional term loans held in CLO portfolios, standardized to have mean zero and standard deviation one. The vertical axis shows the marginal effect of a 1pp increase in O&G exposure on $\Delta \ln(\text{Holdings})$ after the June 2014 shock. The marginal effect of O&G exposure at different levels of CLO dependence is: $\frac{\partial \Delta \ln(\text{Holdings})}{\partial \text{O\&G Exp}} = \beta_3 + \beta_1 \times \text{CLO Dep}$. Filled circles indicate effects significant at the 10% level or better; hollow circles indicate insignificant effects. The error bars show 95% confidence intervals based on two-way clustered standard errors (issuer and month-year). The underlying regression estimates are reported in Appendix Table B.16.

Table 1: Summary Statistics (2013-2015)

	N	Q1	Median	Q3	Mean	Std. Dev.
<i>Panel A: CLO-Level Variables</i>						
Dist. to ID Covenant ($\frac{\text{Test Result}}{\text{Threshold}}$)	3,669	1.0310	1.0364	1.0438	1.0380	0.0339
CLO O&G Exposure (Share)	729	0.0000	0.0104	0.0279	0.0228	0.0722
Share CCC or Worse (by Value)	11,784	0.0082	0.0241	0.0485	0.0625	0.1478
Share Defaulted (by Value)	11,784	0.0000	0.0036	0.0179	0.0415	0.1418
<i>Panel B: Firm-Level Variable</i>						
Issuer O&G Exposure (Share)	6,638	0.0032	0.0146	0.0284	0.0185	0.0191
<i>Panel C: Secondary Loan Market Transactions</i>						
Transaction Amount (\$)	137,114	-500,000	162,373	1,000,000	327,817	1,671,584
Net Transaction Amount - CLO-Issuer (\$)	89,504	-504,700	420,310	1,500,000	502,194	2,209,773
Net Transaction Amount - Issuer (\$)	13,009	-1,900,420	600,000	4,090,527	3,455,173	19,545,160
Transaction Price (\$/\$100)	137,134	99.0000	99.7500	100.0000	96.0195	15.8231
<i>Panel D: Primary Loan Market</i>						
All-in-Drawn Spread (bps, Term Loans)	914	300.0000	350.0000	450.0000	405.6592	175.7261
Facility Maturity (months, Term Loans)	921	59.0000	69.0000	83.0000	65.8643	17.2667
ln(Facility Amount) (Term Loans)	934	18.9513	19.5978	20.2925	19.5702	1.0873
<i>Panel E: Bond Market</i>						
Bond Credit Spread (bps)	10,074	136.4308	228.3545	351.5218	335.1406	505.8652
Bond Bid/Ask Spread (bps)	16,211	0.2010	0.3346	0.5898	0.4501	0.4239
<i>Panel F: Credit Lines</i>						
Δ Drawn/Assets	2,010	0.0000	0.0000	0.0002	0.0006	0.0268
Δ Utilization	1,728	-0.0038	0.0000	0.0095	0.0043	0.1707
<i>Panel G: Real Outcomes</i>						
Debt Growth (Long-term)	2,748	-0.0167	-0.0013	0.0205	0.0215	0.1768
Sales Growth	2,953	-0.0452	0.0161	0.0761	0.0135	0.1951
Cash Flow/Assets	2,645	0.0113	0.0190	0.0284	0.0202	0.0192
Investment/Capital	2,834	-0.0090	0.0028	0.0225	0.0167	0.0728
Acquisitions/Assets	2,761	0.0000	0.0000	0.0043	0.0191	0.0573
R&D Growth	488	-0.0497	0.0179	0.0933	0.0161	0.2571
Δ ln(Employment) (Annual)	686	-0.0251	0.0328	0.1120	0.0588	0.1793
<i>Panel H: CLO Portfolio Characteristics (Loan-Level)</i>						
Interest Rate (%)	3,389,415	3.7500	4.3110	5.2500	4.7329	1.7532
Tenor (years)	3,395,134	3.4219	4.6466	5.7068	4.4666	1.6031
Distressed (Indicator)	3,422,537	0.0000	0.0000	0.0000	0.0146	0.1201
Defaulted Rating (Indicator)	3,422,537	0.0000	0.0000	0.0000	0.0075	0.0861

Notes: This table presents summary statistics for the 2013-2015 sample period surrounding the oil and gas price shock. Panel A reports CLO-level variables including covenant distance and portfolio composition. Panel B reports firm-level oil and gas exposure measures. Panel C reports secondary loan market transaction data. Panel D reports primary loan market characteristics for term loan refinancings. Panel E reports bond market variables. Panel F reports credit line utilization measures. Panel G reports quarterly real outcomes from Compustat. Panel H reports loan-level characteristics from CLO portfolio holdings.

Table 2: Distance to Interest Diversion Covenant and O&G Exposure

	Distance to ID Threshold					
	(1)	(2)	(3)	(4)	(5)	(6)
O&G Share $\times$ Post	-0.2744** (0.1230)	-0.2097* (0.1131)	-0.2523*** (0.0884)	-0.2630*** (0.0925)	-0.2366*** (0.0746)	-0.2277*** (0.0752)
O&G Share	-0.2600 (0.4543)	-0.0912 (0.3337)	0.0607 (0.2532)	0.1732 (0.2324)		
Post	0.0162** (0.0065)	0.0051 (0.0051)			0.0103*** (0.0030)	
CLO Controls		✓	✓	✓		
CLO FE					✓	✓
Manager FE	✓	✓	✓	✓		
Year FE		✓			✓	
Month-Year FE			✓	✓		✓
N	1,867	1,867	1,867	1,867	1,867	1,867
R^2	0.4094	0.4401	0.4748	0.4782	0.8225	0.8290

Notes: The table presents the relation between CLO O&G exposure and distance to the Interest Diversion covenant. The regression specification is: $Y_{c,t} = \beta_0 + \beta_1(\text{CLO O\&G Exposure})_c + \beta_2(\text{Post})_t + \beta_3(\text{CLO O\&G Exposure}_c \times \text{Post}_t) + \gamma'_0 X_c + \alpha_c + \alpha_t + \epsilon_{c,t}$ where $Y_{c,t}$ is the distance to the Interest Diversion threshold ($\ln(\frac{\text{Test Result}}{\text{Covenant Threshold}})$) of CLO c at time t , and X_c denotes the vector of controls, consisting of current CLO age (Columns 2-4) and CLO size (Columns 3-4), and CCC-share and defaulted-share (Column 4). CLO O&G Exposure $_c$ (labeled “O&G Share” in the table) is the O&G share of CLO c before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by CLO and month-year.

Table 3: Transaction-Level Trading Effects

	Net Transaction Amount (\$ mn)					
	(1)	(2)	(3)	(4)	(5)	(6)
O&G Share $\times$ Post	-19.5619*** (2.4993)	-19.6532*** (2.5105)	-18.9647*** (2.3992)	-18.1114*** (2.3343)	-15.1572*** (2.6903)	-15.6710*** (2.6460)
O&G Share	17.4927*** (1.8845)	17.6034*** (1.8868)	17.2287*** (1.8214)	17.3790*** (1.9662)		
Post	0.3279*** (0.0766)	0.4030*** (0.0884)			0.2150** (0.0900)	
Manager FE			✓			
Rating-Industry FE				✓		
Issuer-Loan Type FE					✓	✓
Year FE		✓			✓	
Month-Year FE			✓	✓		✓
Currency FE	✓	✓	✓	✓	✓	✓
<i>N</i>	122,869	122,869	122,869	122,869	122,869	122,869
<i>R</i> ²	0.0060	0.0062	0.0366	0.0280	0.0740	0.0788

Notes: The table presents the relation between firm O&G exposure and transaction amount (in millions of dollars) for non-O&G firms. The regression specification is: $Y_{i,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure})_f + \beta_2(\text{Post})_t + \beta_3(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \gamma_0 Z_f + \alpha_{f,l} + \alpha_t + \epsilon_{i,t}$ where $Y_{i,t}$ is the transaction amount of loan i at time t issued by firm f ($i \in f$), l denotes the loan-type, and Z is a vector of firm controls including rating, industry, and currency. Firm O&G Exposure _{f} (labeled "O&G Share" in the table) measures the value-weighted average O&G share across all CLOs holding firm f 's debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Column 1 includes currency fixed effects. Column 2 adds year fixed effects. Column 3 adds manager and month-year fixed effects. Column 4 adds rating-industry and month-year fixed effects. Column 5 adds issuer-loan type and year fixed effects. Column 6 includes issuer-loan type and month-year fixed effects. Standard errors are two-way clustered by CLO $\times$ issuer and trade date.

Table 4: Secondary Loan Price and O&G Exposure

	Transaction Price (per \$100 par)					
	(1)	(2)	(3)	(4)	(5)	(6)
O&G Share $\times$ Post	-268.5264*** (56.2782)	-270.1423*** (56.2311)	-253.0199*** (50.0003)	-99.5433*** (29.5280)	-109.6407*** (34.5443)	-97.8818*** (33.7559)
O&G Share	296.0194*** (53.1998)	297.5760*** (53.3582)	278.7714*** (47.4725)	71.0708*** (23.3601)		
Post	7.8923*** (1.7066)	7.9419*** (1.8207)			2.8665** (1.1563)	
Manager FE			✓			
Rating-Industry FE				✓		
Issuer-Loan Type FE					✓	✓
Year FE		✓			✓	
Month-Year FE			✓	✓		✓
Currency FE	✓	✓	✓	✓	✓	✓
N	122,885	122,885	122,885	122,885	122,885	122,885
R^2	0.1054	0.1054	0.1725	0.3333	0.4260	0.4333

Notes: The table presents the relation between firm O&G exposure and secondary loan price for non-O&G firms in Table 4. The regression specification is: $Y_{i,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure})_f + \beta_2(\text{Post})_t + \beta_3(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \gamma_0 Z_f + \alpha_{f,l} + \alpha_t + \epsilon_{i,t}$ where $Y_{i,t}$ is the secondary loan price of loan i at time t issued by firm f ($i \in f$), l denotes the loan-type, and Z is a vector of firm controls including rating, industry and currency. Firm O&G Exposure $_f$ (labeled "O&G Share" in the table) measures the value-weighted average O&G share across all CLOs holding firm f 's debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Column 1 includes currency fixed effects. Column 2 adds year fixed effects. Column 3 adds manager and month-year fixed effects. Column 4 adds rating-industry and month-year fixed effects. Column 5 adds issuer-loan type and year fixed effects. Column 6 includes issuer-loan type and month-year fixed effects. Standard errors are two-way clustered by CLO $\times$ issuer and trade date.

Table 5: Primary Institutional Loan Spread and O&G Exposure

	All-in-Drawn Spread				
	(1)	(2)	(3)	(4)	(5)
O&G Share $\times$ Post	1714.1670** (689.2278)	1844.2690** (703.9264)	1882.4884** (695.2067)	1920.7077*** (577.0466)	1493.1116** (594.8328)
Post	-57.7229** (22.3596)	-45.9822 (28.3121)	-53.5417** (25.3724)	-58.0149** (23.2765)	
Maturity				0.0531 (0.3212)	0.0416 (0.2943)
Issuer FE	✓	✓			
Loan Type FE	✓	✓			
Issuer-Loan Type FE			✓	✓	✓
Secured FE		✓	✓	✓	✓
Purpose FE				✓	✓
Distribution Method FE				✓	✓
Seniority FE			✓	✓	✓
Country of Syndication FE				✓	✓
Year FE		✓	✓	✓	
Month-Year FE					✓
Currency FE	✓	✓	✓	✓	✓
N	496	496	496	496	496
R^2	0.8728	0.8794	0.9035	0.9106	0.9248

Notes: The table presents the relation between firm O&G exposure and primary institutional loan spread for non-O&G firms. The regression specification is: $Y_{i,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \beta_2(\text{Post})_t + \beta_3\text{Maturity} + \gamma_0 X_i + \alpha_t + \alpha_{f,l} + \epsilon_{i,t}$ where $Y_{i,t}$ is the all-in-drawn spread (bps) of loan i at time t , of loan type l , issued by firm f ($i \in f$), and X_i is the vector of non-time varying controls associated with loan i including secured status, purpose, distribution method, seniority, currency, and country of syndication, and m, y denote the month and year respectively. Firm O&G Exposure $_f$ (labeled “O&G Share” in the table) measures the value-weighted average O&G share across all CLOs holding firm f ’s debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by issuer and month-year.

Table 6: Price Impact of Loan Flows and O&G Exposure

Amihud Price Impact	(1)	(2)	(3)	(4)	(5)	(6)
O&G Share $\times$ Post	52411.8*** (9448.1922)	52565.5*** (9560.3625)	52363.2*** (9469.4628)	32844.8*** (8521.5820)	18982.9** (9161.8376)	20091.6** (9548.9231)
O&G Share	-49697.5*** (7525.5854)	-49879.9*** (7689.7482)	-50642.3*** (7573.0585)	-23991.3*** (6163.4081)		
Post	-1566.1*** (295.0771)	-1676.8*** (339.5863)			-580.1* (319.1183)	
Manager FE			✓			
Rating-Industry FE				✓		
Issuer-Loan Type FE					✓	✓
Year FE		✓			✓	
Month-Year FE			✓	✓		✓
Currency FE	✓	✓	✓	✓	✓	✓
	122,452	122,452	122,452	122,452	122,452	122,452
R^2	0.0180	0.0181	0.0381	0.1427	0.2326	0.2351

Notes: The table presents the relation between firm O&G exposure and the price impact of loan flows for non-O&G firms. The regression specification is:

$$Y_{i,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure})_f + \beta_2(\text{Post})_t + \beta_3(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \gamma_0 Z_f + \alpha_{f,l} + \alpha_t + \epsilon_{i,t}$$

where $Y_{i,t}$ is the price impact measure for transaction i at time t of a loan issued by firm f (loan $i \in$ firm f), and Z is a vector of firm controls including rating, industry, and currency. Firm O&G Exposure $_f$ (labeled “O&G Share” in the table) measures the value-weighted average O&G share across all CLOs holding firm f ’s debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. The price impact measure is constructed as the ratio of the loan discount in basis points (relative to par) to the net flow in millions of dollars, where net flow is positive for sales and negative for purchases. Column 1 includes currency fixed effects. Column 2 includes year fixed effects. Column 3 includes manager and month-year fixed effects. Column 4 includes rating-industry and month-year fixed effects. Column 5 includes issuer-loan type and year fixed effects. Column 6 includes issuer-loan type and month-year fixed effects. Standard errors are two-way clustered by deal and issuer.

Table 7: Firm Liquidity and O&G Exposure

	Δ Drawn Credit / Assets			Δ Utilization Rate		
	(1)	(2)	(3)	(4)	(5)	(6)
O&G Share $\times$ Post	0.1016*	0.1014*	0.1009*	0.5509*	0.5552*	0.5530*
	(0.0537)	(0.0536)	(0.0538)	(0.3168)	(0.3186)	(0.3188)
Post	-0.0020	-0.0036		-0.0082	-0.0254	
	(0.0018)	(0.0026)		(0.0112)	(0.0166)	
Issuer FE	✓	✓	✓	✓	✓	✓
Year FE		✓			✓	
Quarter-Year FE			✓			✓
N	2,001	2,001	2,001	1,718	1,718	1,718
R ²	0.0429	0.0436	0.0490	0.0312	0.0327	0.0375

Notes: The table presents the relation between firm O&G exposure and credit line usage for non-O&G firms. The regression specification is: $Y_{f,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \beta_2(\text{Post})_t + \alpha_f + \alpha_t + \epsilon_{f,t}$ where $Y_{f,t}$ denotes credit line outcomes for firm f (f) at time t . Drawn credit (Columns 1-3) is the quarterly change in outstanding balance on revolving credit facilities scaled by total assets, expressed in percentage points. Utilization rate (Columns 4-6) is the quarterly change in the ratio of drawn credit to total credit line capacity (drawn + undrawn), expressed in percentage points. Firm O&G Exposure _{f} (labeled "O&G Share" in the table) measures the value-weighted average O&G share across all CLOs holding firm f 's debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are clustered by issuer.

Table 8: Firm Adjustments and O&G Exposure

	Debt Growth	Sales Growth	Cash Flow	Investment	Acquisitions	R&D Growth	Emp. Growth
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
O&G Share $\times$ Post	-0.8898* (0.4982)	-0.7729** (0.3662)	-0.0889* (0.0492)	-0.3178* (0.1839)	-0.2839** (0.1422)	-1.8168** (0.8571)	-1.8163** (0.8212)
Issuer FE	✓	✓	✓	✓	✓	✓	✓
Quarter-Year FE	✓	✓	✓	✓	✓	✓	✓
<i>N</i>	2,740	2,946	2,638	2,830	2,750	487	659
<i>R</i> ²	0.1205	0.0705	0.6263	0.2235	0.3748	0.0560	0.4819

Notes: The table presents the relation between firm O&G exposure and firm characteristics for non-O&G firms. The regression specification is: $Y_{f,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \alpha_t + \alpha_f + \epsilon_{f,t}$ where $Y_{f,t}$ are various firm characteristics for firm f at time t (f). Firm O&G Exposure _{f} (labeled “O&G Share” in the table) measures the value-weighted average O&G share across all CLOs holding firm f ’s debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Long-term debt growth (Column 1) is the quarterly log-difference in long-term debt. Sales growth (Column 2) is the quarterly log-difference in sales. Cash flow (Column 3) is operating income before depreciation minus interest expense minus taxes, scaled by lagged total assets. Investment-capital ratio (Column 4) is the change in capital stock scaled by lagged capital stock, where capital stock is recursively constructed from gross property, plant and equipment. Acquisitions (Column 5) is quarterly acquisition expenditures scaled by lagged assets. R&D growth (Column 6) is the quarterly log-difference in R&D expenditures. Employment growth (Column 7) is the annual log-difference in total employees. See Appendix Section C for details. All variables are measured at quarterly frequency except employment growth, which is measured at annual frequency. Standard errors are clustered by issuer.

Table 9: Heterogeneous Effects by Firm Financial Characteristics

	Bond Access		Rollover Risk		Loan Refinancing	
	Access (1)	No Access (2)	Low (3)	High (4)	Early (5)	Late (6)
<i>Panel A: Transaction Volume (face amount, \$ millions)</i>						
O&G Share $\times$ Post	-12.2061*** (2.4151)	-19.8124*** (6.8585)	-12.5721*** (2.3328)	-21.2278** (10.3358)	-8.1634 (11.9525)	-21.3216*** (8.1135)
Observations	113,484	23,323	125,527	11,281	5,847	14,202
R ²	0.0877	0.0808	0.0863	0.0962	0.1075	0.0825
Issuer-Loan Type FE	✓	✓	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓	✓	✓
Currency FE	✓	✓	✓	✓	✓	✓
<i>Panel B: Secondary Market Price (per \$100)</i>						
O&G Share $\times$ Post	-59.2691* (30.6807)	-225.5768*** (63.4592)	-69.3744** (29.7106)	-195.7179*** (65.5776)	33.6372 (157.4435)	-263.7967*** (60.5663)
Observations	113,499	23,327	125,541	11,286	5,849	14,204
R ²	0.5019	0.2417	0.4531	0.6226	0.2042	0.2003
Issuer-Loan Type FE	✓	✓	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓	✓	✓
Currency FE	✓	✓	✓	✓	✓	✓
<i>Panel C: Investment-Capital Ratio</i>						
O&G Share $\times$ Post	0.1426 (0.1536)	-0.9748*** (0.3319)	-0.2005 (0.1749)	-2.5802*** (0.7217)	-0.8170 (0.5099)	-1.0491** (0.4343)
Observations	1,522	1,308	2,618	212	452	685
R ²	0.2398	0.2253	0.2200	0.3097	0.2087	0.2836
Issuer FE	✓	✓	✓	✓	✓	✓
Quarter-Year FE	✓	✓	✓	✓	✓	✓

Notes: The table presents the relation between firm O&G exposure and transaction amount in Panel A, transaction price in Panel B, and investment in Panel C for non-O&G firms across various dimensions of financial constraints. The regression specifications in Panels A and B take the form : $Y_{i,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \gamma_0 Z_f + \alpha_{f,l} + \alpha_t + \epsilon_{i,t}$ where $Y_{i,t}$ is the transaction amount (Panel A) and secondary loan price (Panel B) of loan i at time t issued by firm f ($i \in f$), l denotes the loan-type, and Z is a vector of firm controls including currency. The regression specification in Panel C takes the form: $I_{f,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \alpha_f + \alpha_t + \epsilon_{f,t}$ where $I_{f,t}$ denotes the investment-capital ratio, defined as the change in capital stock scaled by lagged capital stock, where capital stock is recursively constructed from gross property, plant and equipment. Firm O&G Exposure _{f} (labeled "O&G Share" in the table) measures the value-weighted average O&G share across all CLOs holding firm f 's debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Columns 1-2 segment firms by bond market access: firms with access to the bond market are in column 1 and firms without access are in column 2. Columns 3-4 segment firms by rollover risk: low rollover risk firms (loan maturity more than 6 months away) are in Column 3 and high rollover risk firms (loan maturity within 6 months) are in Column 4. Columns 5-6 segment firms without bond market access by loan refinancing timing: early refinancing firms (refinanced before median date in sample) are in Column 5 and late refinancing firms (refinanced after median date) are in Column 6. Standard errors are two-way clustered by CLO $\times$ issuer and trade date in Panels A and B, and clustered by issuer in Panel C.

Table 10: Selling Propensity by Secondary Loan Price Relative to Par and O&G Exposure

Panel A: $\mathbb{1}_{(\text{loan price} > 100)}$					
	(1)	(2)	(3)	(4)	(5)
O&G Share $\times$ Post	-7.4468*** (1.0987)	-7.5187*** (1.0952)	-7.2249*** (1.0060)	-6.7249*** (1.1314)	-6.0223*** (1.0911)
O&G Share	8.6282*** (0.9010)	8.6653*** (0.8973)	7.3429*** (0.9482)		
Post	0.1116*** (0.0318)	0.0471 (0.0340)		-0.0183 (0.0376)	
Rating-Industry FE			✓		
Issuer-Loan Type FE				✓	✓
Year FE		✓		✓	
Month-Year FE			✓		✓
Currency FE	✓	✓	✓	✓	✓
<i>N</i>	55,251	55,251	55,251	55,251	55,251
<i>R</i> ²	0.0150	0.0194	0.1600	0.2471	0.3119
Panel B: $\mathbb{1}_{(\text{loan price} < 90)}$					
	(1)	(2)	(3)	(4)	(5)
O&G Share $\times$ Post	7.6186*** (1.0742)	7.6890*** (1.0911)	3.5575*** (0.7187)	2.4036*** (0.7467)	2.1334*** (0.7317)
O&G Share	-7.4193*** (0.9319)	-7.4890*** (0.9545)	-1.5781** (0.6470)		
Post	-0.2102*** (0.0305)	-0.2174*** (0.0354)		-0.0798*** (0.0230)	
Rating-Industry FE			✓		
Issuer-Loan Type FE				✓	✓
Year FE		✓		✓	
Month-Year FE			✓		✓
Currency FE	✓	✓	✓	✓	✓
<i>N</i>	55,251	55,251	55,251	55,251	55,251
<i>R</i> ²	0.0595	0.0596	0.3382	0.5274	0.5369

Notes: The table presents the relation between firm O&G exposure and propensity to sell loans issued by non-O&G firms by price categorization. The regression specification is: $\mathbb{1}_{(\text{price} \leq p)_{i,t}} = \beta_0 + \beta_1(\text{Firm O\&G Exposure})_f + \beta_2(\text{Post})_t + \beta_3(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \alpha_{f,l} + \gamma_0 Z_f + \alpha_t + \epsilon_{i,t}$ where $\mathbb{1}_{(\text{price} \leq p)_{i,t}}$ is an indicator that takes a value 1 if the transacted price of secondary loan price issued by firm f at time t ($i \in f$) is greater than \$100 (per \$100 par) in Panel A, and below \$90 (per \$100 par) in Panel B, Z is a vector of firm controls including rating, industry, and currency, l denotes the loan-type. Firm O&G Exposure _{f} (labeled “O&G Share” in the table) measures the value-weighted average O&G share across all CLOs holding firm f ’s debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by CLO $\times$ issuer and trade date.

Table 11: Contractual Arbitrage: Effects by Credit Quality

	Secondary Loan Price		All-In-Drawn Spread		Bond Credit Spread		Investment-Capital Ratio	
	Non-Distressed	Distressed	Non-Distressed	Distressed	Non-Distressed	Distressed	Non-Distressed	Distressed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
O&G Share $\times$ Post	-53.6199*** (17.2806)	-96.8682** (38.8396)	34.0367 (898.3463)	3749.2489* (1969.8295)	4596.6457 (3254.1626)	11328.8524** (5447.5858)	-0.2849 (0.3325)	-0.7049 (0.5184)
Issuer-Issue Type FE	✓	✓	✓	✓	✓	✓		
Issuer FE							✓	✓
Month-Year FE	✓	✓	✓	✓	✓	✓		
Quarter-Year FE							✓	✓
Currency FE	✓	✓	✓	✓				
<i>N</i>	29,258	107,269	175	336	4,191	3,301	1,142	924
<i>R</i> ²	0.3699	0.4650	0.9399	0.9014	0.4401	0.6313	0.2257	0.1881

Notes: This table examines whether the effects of CLO sales concentrate among firms with poor ex-ante credit quality. The regression specification takes the form

$$Y_{i,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \alpha_{i/f} + \alpha_t + \epsilon_{i,t}$$

where $Y_{i,t}$ denotes the outcome variable for observation i at time t . The outcomes are: secondary loan price per \$100 par (Columns 1-2), all-in-drawn spread in basis points (Columns 3-4), bond credit spread in basis points (Columns 5-6), and investment-capital ratio (Columns 7-8). Firm O&G Exposure_{*f*} measures the weighted average O&G share of firm f across all CLOs holding its debt, measured as of May 2014 (pre-shock). Post equals one after June 2014. Firms are classified as *distressed* (Columns 2, 4, 6, 8) if they meet any of the following criteria between 2013 and 2015: (i) their loans trade below 90¢/\$ in secondary markets, (ii) they experience CLO-reported defaults, or (iii) they carry CCC or worse credit ratings. These three criteria correspond directly to the components that enter CLO par coverage calculations. *Non-distressed* firms (Columns 1, 3, 5, 7) meet none of these criteria during the sample period. The specification includes issuer-loan type fixed effects in columns 1-4, issuer-bond type fixed effects in columns 5-6, firm and quarter-year fixed effects in columns 7-8, and month-year fixed effects in columns 1-6. Columns 1-4 also include currency fixed effects. Columns 3-4 additionally control for loan maturity. Standard errors are clustered by CLO $\times$ issuer and deal in columns 1-2, by issuer and month-year in columns 3-6, and by issuer in columns 7-8.

Table 12: Portfolio Derisking: Loan Characteristics and O&G Exposure

	Interest Rate	Tenor	$\mathbb{1}[\text{Distressed}]$	$\mathbb{1}[\text{Defaulted}]$
	(1)	(2)	(3)	(4)
O&G Share $\times$ Post	-3.9543*	-3.0558**	-0.1770**	-0.1438**
	(2.0117)	(1.5040)	(0.0849)	(0.0705)
CLO-Issuer FE	✓	✓	✓	✓
Loan Type-Month-Year FE	✓	✓	✓	✓
N	3,371,374	3,376,551	3,403,661	3,403,661
R^2	0.8835	0.8653	0.7646	0.7163

Notes: The table presents the relation between firm O&G exposure and characteristics of loans held in CLO portfolios for non-O&G firms. The regression specification is: $Y_{i,c,t} = \beta_0 + \beta_1 (\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \alpha_{f,c} + \alpha_{l,t} + \epsilon_{i,c,t}$ where $Y_{i,c,t}$ denotes the outcome variable for loan i issued by firm f and held in CLO c at time t (loan $i \in \text{firm } f$), l denotes the loan type, t denote the month-year respectively. Firm O&G Exposure _{f} (labeled “O&G Share” in the table) measures the value-weighted average O&G share across all CLOs holding firm f ’s debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Interest Rate (Column 1) is the annual loan interest rate in percent. Tenor (Column 2) is the remaining time to maturity in years. Distressed (Column 3) is an indicator for loans reported as “defaulted” by the CLO, which includes payment defaults and covenant breaches. Defaulted (Column 4) is an indicator for loans with a formal S&P rating of D from S&P. Standard errors are two-way clustered by CLO $\times$ issuer and month-year.

Table 13: Instrumental Variables: CLO Sales and Firm Outcomes

	Panel A: First Stage			
	(1)	(2)	(3)	(4)
	Net Sales / Holdings _{t-1}			
O&G Share × Post	4.0313*** (0.9035)	4.0940*** (0.9074)	4.1581*** (0.9164)	4.4101*** (0.8993)
Post	-0.0539** (0.0235)	-0.0754*** (0.0254)		
Firm FE	✓	✓	✓	✓
Year FE		✓		
Month-Year FE			✓	
Industry × Month-Year FE				✓
Observations	12,066	12,066	12,066	12,066
R ²	0.1718	0.1730	0.1799	0.2485
Kleibergen-Paap F	19.91	20.36	20.59	24.05
	Panel B: Second Stage			
	(1)	(2)	(3)	(4)
	Secondary Loan Price	All-in-Drawn Spread	Credit Spread	Investment Ratio
Net Sales / Holdings _{t-1}	-16.7302** (6.8515)	287.8221** (141.8914)	771.3622* (398.9171)	-0.0803** (0.0372)
Issuer-Loan/Bond Type FE	✓	✓	✓	
Month-Year FE	✓	✓	✓	
Quarter-Year FE				✓
Currency FE	✓	✓		
Firm FE				✓
Industry FE				✓
Observations	54,204	253	2,319	895

Notes: This table presents instrumental variables estimates of the causal effect of CLO sales on firm outcomes. Panel A reports first-stage estimates at the firm-month level. Panel B reports second-stage estimates. Net sales are sales minus purchases of institutional term loans by CLOs, computed from secondary-market transaction data and aggregated to the firm level. In columns 1–3 of Panel B, the endogenous regressor is monthly net sales scaled by holdings at the end of the prior month; in column 4, it is net sales during the quarter scaled by holdings at the beginning of the quarter, measured as the last reported balance of the prior quarter. The regressor enters with a one-period lag (one month in columns 1–3; one quarter in column 4), so the estimates capture the effect of the prior period's liquidation pressure. The first stage is:

$$\frac{\text{Net Sales}_{f,t}}{\text{Holdings}_{f,t-1}} = \gamma_0 + \gamma_1(\text{O\&G Exposure}_f \times \text{Post}_t) + \gamma_2 \text{Post}_t + \alpha_f + \alpha_t + u_{f,t}$$

where $\text{O\&G Exposure}_f$ is the pre-shock (May 2014) value-weighted average O&G share across CLOs holding firm f 's debt and Post equals one after June 2014. The first stage for column 4 of Panel B is the quarterly analog estimated on the investment sample. The second stage is:

$$Y_{f,i,t} = \beta_0 + \beta_1(\widehat{\text{Net Sales/Holdings}})_{f,t-1} + \alpha_{f,i} + \alpha_t + \epsilon_{f,i,t}$$

The dependent variable is the secondary loan price per \$100 of par, estimated on sale transactions (column 1); the all-in-drawn spread in basis points on refinancing institutional term loans (column 2); the bond credit spread in basis points (column 3); or the investment-capital ratio in percentage points, defined as the change in the capital stock scaled by the lagged capital stock (column 4; see Appendix Section C). All specifications use non-O&G firms during 2013–2015. Standard errors in Panel A are two-way clustered by issuer and month-year. Standard errors in Panel B are clustered by CLO×issuer (column 1) and by issuer (columns 2–4). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Supplemental Appendix

Covenant-Driven Fire Sales

Shohini Kundu¹

Appendix A Contractual Arbitrage

A.1 Numerical Example

This section demonstrates how the piecewise design of covenant accounting rules influences CLO liquidation incentives. The example isolates the CCC/Caa1 bucket rule to highlight the discontinuity created by the 7.5% limit. It abstracts from other overlapping haircut definitions—such as discount obligations or defaulted loans—that may also apply in practice. The purpose is to illustrate the directional incentive created by the CCC threshold rather than to replicate the full complexity of typical indentures. The general framework may be extended to richer contractual environments.

Let the initial book value of assets be 100 and liabilities be 100. Let $\tau = 7.5\%$ denote the stipulated portfolio share of CCC/Caa1 loans. Assume each loan has equal face value.

Before distress:

$$ID = 1. \tag{A.1}$$

Now suppose distress occurs such that:

- Share of higher-priced CCC loans, g , is 7.5%
- Share of lower-priced CCC loans, b , is 7.5%
- Market price of higher-priced CCC loans, γ , is 95¢/\$
- Market price of lower-priced CCC loans, β , is 20¢/\$

Total CCC exposure is now 15%, exceeding the 7.5% threshold. Under the CCC bucket rule, the excess 7.5% is marked to market starting with the lowest-priced holdings. The ID ratio becomes:

$$ID = \frac{(1 - (0.15 - 0.075))100 + (0.15 - 0.075) \times 0.20 \times 100}{100} \tag{A.2}$$

$$= \boxed{0.9400}. \tag{A.3}$$

If the CLO instead sells the higher-priced CCC loans (the 95¢/\$ loans), remaining CCC exposure falls to 7.5%, eliminating excess exposure under the CCC bucket rule. The ID ratio becomes:

$$ID = \frac{(1 - 0.075)100 + 0.075 \times 0.95 \times 100}{100} \tag{A.4}$$

$$= \boxed{0.99625}. \tag{A.5}$$

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This example abstracts from the possibility that a 20¢/\$ loan may also qualify as a discount or defaulted obligation in typical indentures, in which case it could remain marked at purchase price or projected recovery even after CCC exposure falls below 7.5%. Incorporating such overlapping haircut definitions would reduce the numerical improvement in the ID ratio but would not eliminate the underlying incentive: when accounting rules apply discontinuously across buckets, managers can improve covenant ratios by selectively liquidating higher-valued distressed loans.

Appendix Section A.2 generalizes this logic. The key insight is that when marking rules apply in a piecewise fashion, CLO managers maximize covenant improvement by selling risky loans in descending order of market value. Similar reasoning applies to defaulted loans and discount obligations whenever realized market value exceeds the accounting value used in par coverage calculations.

A.2 General Case

Let τ denote the stipulated portfolio share of CCC/Caa1 loans, A total CLO assets, and L total CLO liabilities. Suppose A consists of N discrete assets, each with initial book value normalized to 1. The initial OC/ID ratio is

$$OC/ID = \frac{N}{L}.$$

Suppose n of these assets become risky (e.g., downgraded to CCC/Caa1), so the CLO breaches its CCC/Caa1 limit:

$$\frac{n}{N} > \tau.$$

Let $\{\beta_1, \beta_2, \dots, \beta_n\}$ denote the market values of the n risky assets, ordered so that

$$\beta_1 \leq \beta_2 \leq \dots \leq \beta_n.$$

To restore compliance the manager must sell t risky assets with $0 \leq t \leq n$. Define t directly as the number of risky assets to be sold.

The non-risky assets (there are $N - n$ of them) each retain value 1. The total post-sale asset value depends on which risky assets are sold.

Case A: sell the t lowest-valued risky assets. If the manager sells $\{\beta_1, \dots, \beta_t\}$ then the remaining risky assets are $\{\beta_{t+1}, \dots, \beta_n\}$ and the post-sale asset value is

$$\text{Assets}_A = (N - n) + \sum_{i=t+1}^n \beta_i,$$

hence

$$OC/ID_A = \frac{(N - n) + \sum_{i=t+1}^n \beta_i}{L}.$$

Case B: sell the t highest-valued risky assets. If the manager sells $\{\beta_{n-t+1}, \dots, \beta_n\}$ then the remaining risky assets are $\{\beta_1, \dots, \beta_{n-t}\}$ and the post-sale asset value is

$$\text{Assets}_B = (N - n) + \sum_{i=1}^{n-t} \beta_i,$$

hence

$$OC/ID_B = \frac{(N - n) + \sum_{i=1}^{n-t} \beta_i}{L}.$$

Because the sequence is ordered, the sum of the largest $(n - t)$ risky values is at least as large as the sum of the smallest $(n - t)$ risky values:

$$\sum_{i=t+1}^n \beta_i \geq \sum_{i=1}^{n-t} \beta_i.$$

Therefore

$$OC/ID_A \geq OC/ID_B.$$

Thus, selling the lowest-valued risky assets (Case A) yields a weakly higher post-sale OC/ID than selling the highest-valued risky assets (Case B). In other words, the manager maximizes the remaining-assets value, and so the covenant ratio, by selling the smallest (β) risky loans.

Appendix B Selection and Matching of CLO Portfolios

This section assesses the magnitude of selection concerns, underlying the empirical strategy.

First, I find that portfolios are largely overlapping across CLOs. While the total value of outstanding CLOs increased from 2007 through 2019 – from \$308 billion to \$606 billion ([International Monetary Fund \(2020\)](#)) – the number of issuers across CLOs experienced a rather meager increase from 4,229 to 4,659 over the same time horizon. The median issuer's loans were held in 78 CLOs in the aftermath of the Great Financial Crisis of 2008 ([Kundu \(2023\)](#)). CLO exposures are highly correlated; 90% of CLOs are exposed to the top 50 US borrowers, and 80% are exposed to the top five borrowers ([Financial Stability Board \(2019\)](#)).

Second, I find no evidence that the capital covenant threshold varies with O&G exposure before the shock. In Appendix Table [B.1](#), I investigate the relationship between O&G exposure and the ID threshold, using a within manager estimator to control for managerial style, risk appetite, and other factors. I also include CLO controls, such as age, size, and defaulted-share, as well as arranger, trustee, and time fixed effects. The results show no stable or statistically significant point estimates, suggesting no relation between O&G exposure and the covenant threshold. Moreover, since the CLO covenant threshold cannot be renegotiated, it is unlikely to be influenced by a CLO's subsequent investment decisions and trading behavior.

Third, before the shock, the distribution of investments across non-O&G industries is similar for CLOs with high and low O&G exposure, as shown in Appendix Figure [B.1](#). This finding supports the interpretation that subsequent differential effects reflect O&G-induced fire sale pressure rather than pre-existing portfolio differences.⁴¹

⁴¹The industry Herfindahl-Hirschman Index (HHI) is 0.0574 for CLOs with high O&G exposure and 0.0598 for

Fourth, I compare the geographic concentration of investments for CLOs with high and low O&G exposure before the shock in Appendix Figure B.2. Using the *State* identifier in DealScan, I find that the geographic concentration is very similar between the two sets of CLO portfolios, indicating minimal differences in investment location.⁴²

Fifth, I compare observable firm characteristics between CLOs with high and low O&G exposure before the shock in Appendix Table B.2. The characteristics of firms held by CLOs with high O&G exposure are similar to those held by CLOs with low O&G exposure across several dimensions, including size, age, capital expenditure, investment-capital ratio, leverage, long-term debt growth, cash flow, sales growth, acquisitions, R&D growth. No material differences in firm characteristics are found across CLOs with differing O&G exposure.

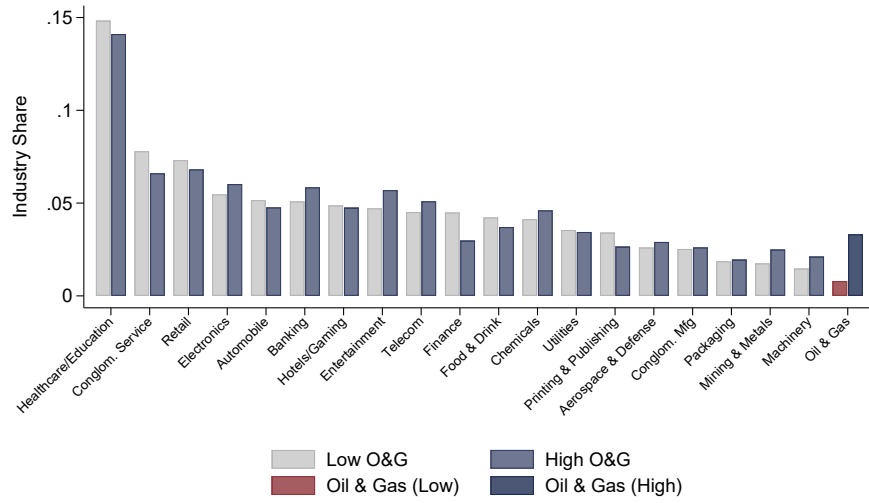
Sixth, I investigate whether firm sensitivity to oil price influences CLO selection in Appendix Table B.3. I use a within manager-arranger-trustee estimator to absorb all variation related to management style, risk appetite, specialization, taste, reputation and sophistication. In addition, I include several CLO and issuer controls, as well as time fixed effects. I do not find robust or statistically significant evidence that the covariance between oil price and firm profitability can predict CLO selection. Further, the R^2 associated with the simple OLS regression in column 1 is virtually nil. Hence, I rule out concerns of portfolio hedging with respect to O&G exposure.

In summary, these results suggest the following. CLOs hold largely overlapping portfolios. Firm, sectoral and geographic characteristics of CLO portfolios with different O&G exposures are largely similar. There is no strong relationship between CLO O&G exposure and the covenant threshold, before the shock, nor is there evidence that CLOs hedge against O&G exposure with the remaining allocation of the portfolio. As the O&G price plunge was not a foreseeable event, the O&G shares may be viewed as a random assignment. In other words, a CLO portfolio may be considered a combination of two distinct portfolios: a portfolio of O&G loans, and, the “market” portfolio – a portfolio of non-O&G loans. Variation in O&G exposure depends on how managers weigh the trade-off between enhancing arbitrage and default risk (Ashton (2020)). This is consistent with Figure 4 which indicates that O&G loans exhibited higher ratings than non-O&G loans yet yielded higher returns than non-O&G loans in each rating category.

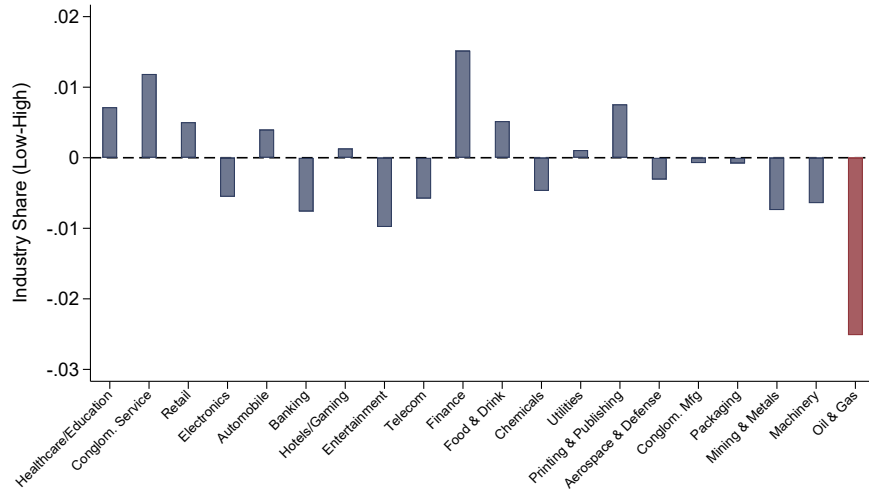
CLOs with low O&G exposure for non-O&G industries. The Euclidean distance between the two vectors of the industry share of firms held in CLOs with high and low CLO O&G exposure is 0.0416. The Kolmogorov-Smirnov test for equality of distribution functions fails to reject the null hypothesis, with a p-value of 0.9993.

⁴²The state Herfindahl-Hirschman Index (HHI) is 0.0392 for CLOs with high O&G exposure and 0.0408 for CLOs with low O&G exposure for non-O&G industries. The Euclidean distance between the two vectors of the state share of firms held in CLOs with high and low CLO O&G exposure is 0.0120. The Kolmogorov-Smirnov test for equality of distribution functions fails to reject the null hypothesis, with a p-value of 0.8950.

Figure B.1: Industry Composition by CLO O&G Exposure (Pre-Period)



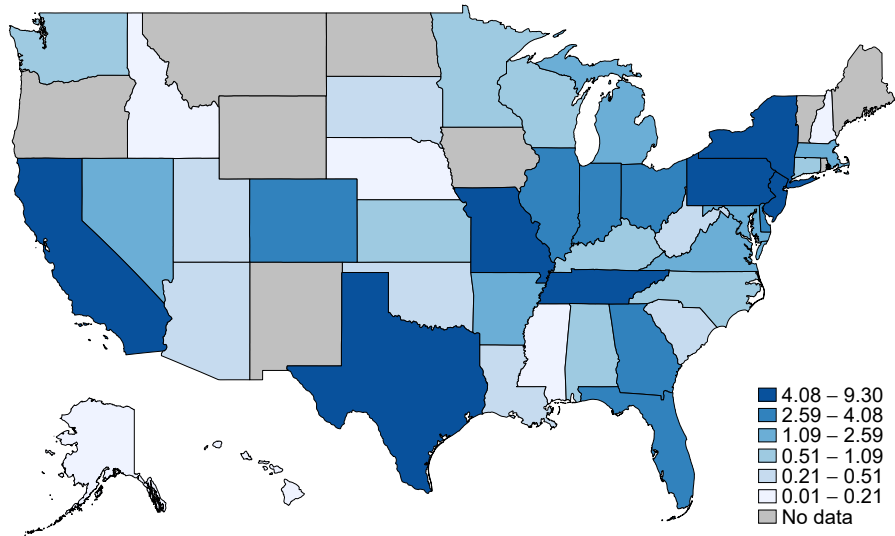
(a) Industry Distribution: Low vs High O&G Exposure



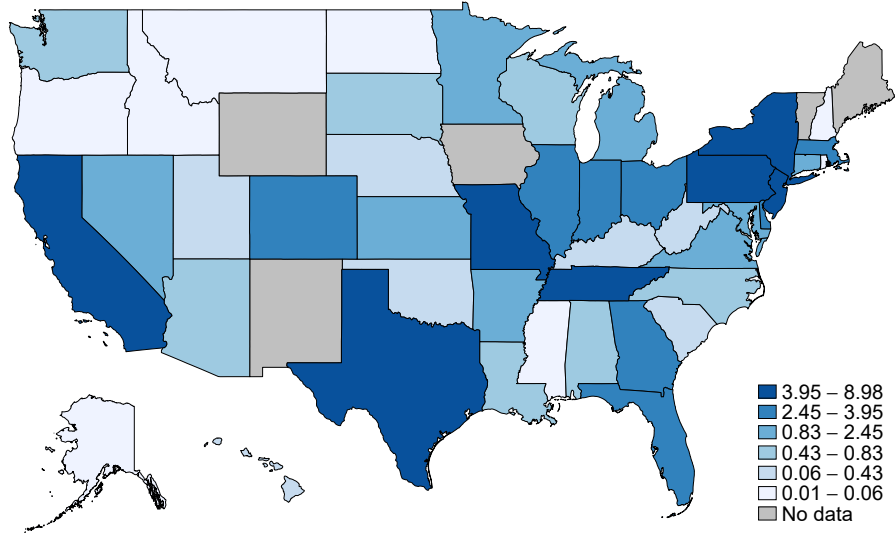
(b) Difference in Industry Shares (Low - High)

Notes: The figure compares industry portfolio composition between low- and high-O&G-exposure CLOs in the pre-shock period. High-O&G-exposure CLOs are defined as those with O&G portfolio shares above the median; low-O&G-exposure CLOs are below the median. Appendix Figure B.1a displays industry shares for the top 20 industries by total holdings. Light gray bars show low-O&G CLOs; dark blue bars show high-O&G CLOs. O&G is highlighted in red/dark blue to emphasize the primary difference between groups. Appendix Figure B.1b plots the difference in industry shares (Low - High) for each industry, with the horizontal line at zero indicating no difference. Despite the mechanical difference in O&G holdings (by construction), the two groups hold nearly identical portfolios across all other industries. Formal distributional tests indicate similarity: the Herfindahl-Hirschman Index is 0.0598 for low-O&G CLOs vs. 0.0574 for high-O&G CLOs (difference = 0.0024); the Euclidean distance between distributions is 0.0416; and a Kolmogorov-Smirnov test cannot reject distributional equality ($p = 0.9993$).

Figure B.2: Geographic Composition by CLO O&G Exposure



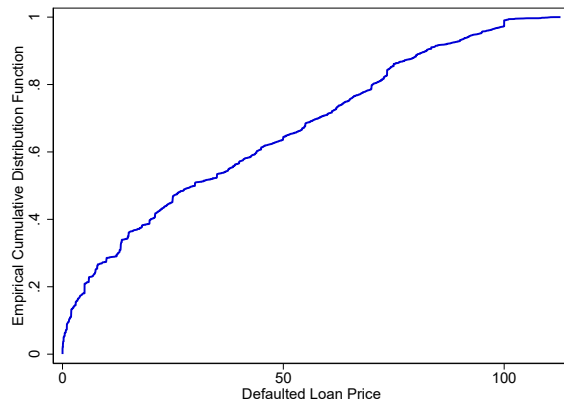
(a) Low O&G Exposure



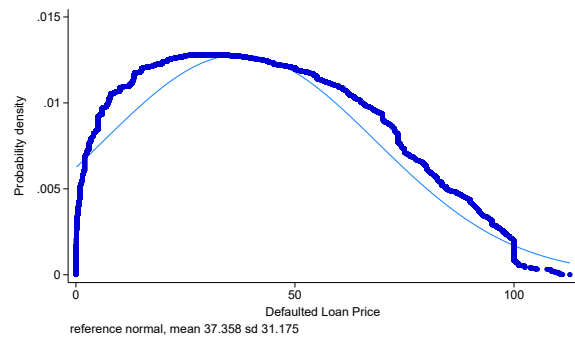
(b) High O&G Exposure

Notes: This figure compares the geographic concentration of non-O&G firms for CLOs with high O&G exposure to CLOs with low O&G exposure in January, 2013. CLOs with above-median O&G exposure have high O&G exposure while CLOs with below-median O&G exposure have low O&G exposure. The plots present the share of firms headquartered in each state. For CLOs with low O&G exposure, the Herfindahl-Hirschman Index (HHI) is 0.0408, while it is 0.0392 for CLOs with high O&G exposure. The Euclidean distance between the two vectors of state share of firms held in CLOs with high and low CLO O&G exposure is 0.0120. The Kolmogorov-Smirnov test for equality of distribution functions fails to reject the null hypothesis, with a p-value of 0.8950.

Figure B.3: Distributions of Defaulted Loan Prices



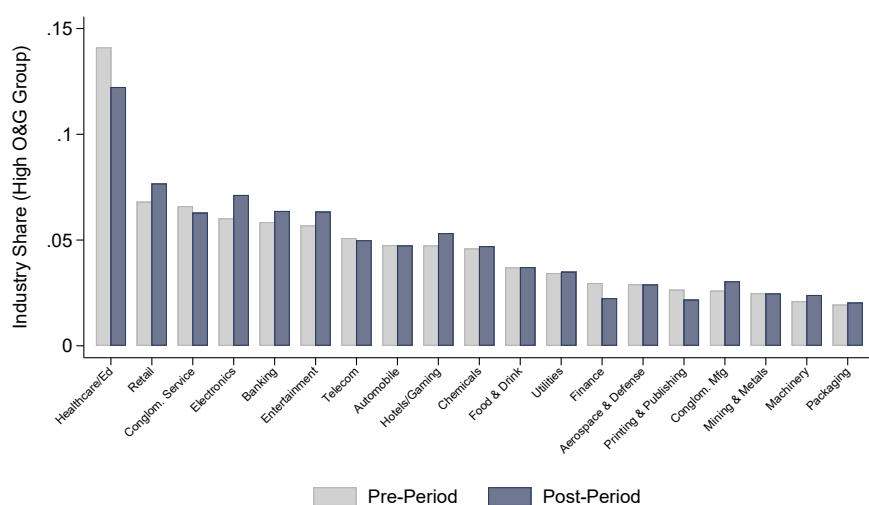
(a) CDF of Defaulted Loan Prices



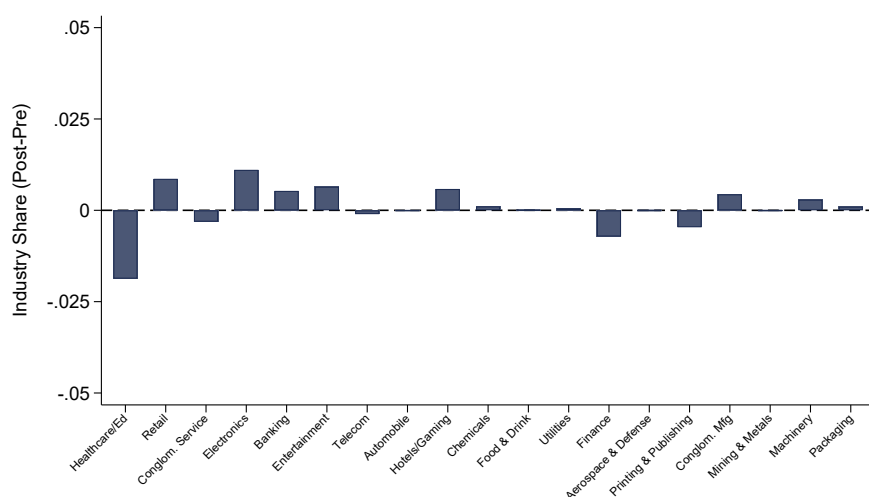
(b) PDF of Defaulted Loan Prices

Notes: The figure presents the cumulative distribution function (CDF) and probability density function (PDF) of defaulted loan prices. Appendix Figure B.3a presents the CDF of defaulted loan prices. Appendix Figure B.3b presents the PDF of defaulted loan prices.

Figure B.4: Portfolio Rebalancing by High-O&G-Exposure CLOs



(a) Industry Distribution: Pre vs Post



(b) Change in Industry Shares (Post - Pre)

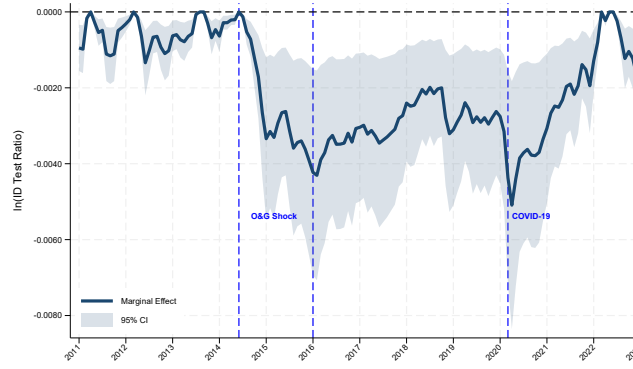
Notes: The figure examines how high-O&G-exposure CLOs (above median O&G share) rebalance their portfolios following the June 2014 oil price collapse. Appendix Figure B.4a compares industry shares in May 2014 (pre-period, light gray) with December 2014 (post-period, dark blue) for the top 20 industries. Appendix Figure B.4b shows the change in each industry's portfolio share (Post - Pre). Distributional tests indicate limited overall rebalancing: the Herfindahl-Hirschman Index changes from 0.0574 (pre) to 0.0566 (post), a difference of 0.0006; the Euclidean distance between pre- and post-shock distributions is 0.0292; and a Kolmogorov-Smirnov test cannot reject distributional equality ($p = 0.9598$).

Figure B.5: Placebo Tests: Random O&G Exposure

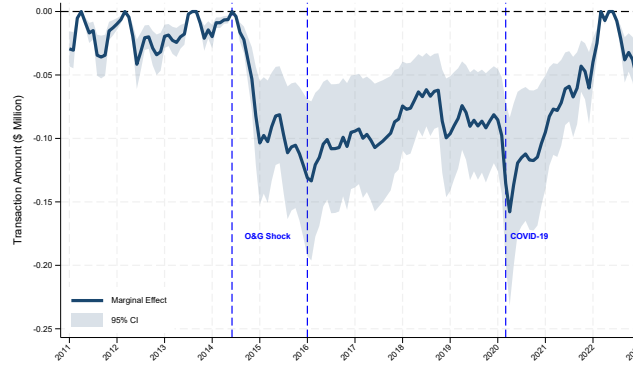


Notes: This figure presents histograms from 1,000 Monte Carlo simulations of placebo regressions. Firm O&G exposure is randomly assigned (drawn from a uniform distribution taking values 0 or 1) while keeping the actual June 2014 shock date fixed. Each panel shows the distribution of the coefficient on Placebo Share $\times$ Post from the most conservative specifications of the main analysis. Panel (a) uses CLO-level covenant distance ($\ln(\text{ID Test Ratio})$) as the outcome variable. Panel (b) uses transaction face amount. Panel (c) uses secondary loan prices. Panel (d) uses all-in-drawn spreads for refinancing term loans. Panel (e) uses bond credit spreads. Panel (f) uses changes in drawn lines of credit. Panel (g) uses the investment-capital ratio. The red dashed vertical line marks zero. The mean placebo coefficients and t-statistics are: (a) Mean = -0.0001, t = -1.3579; (b) Mean = 0.0003, t = 0.5189; (c) Mean = -0.0031, t = -0.6771; (d) Mean = 0.1360, t = 0.2841; (e) Mean = -0.3826, t = -1.1749; (f) Mean = 0.0001, t = 0.6233; (g) Mean = -0.0003, t = -1.5277. In all cases, the null hypothesis that the mean coefficient equals zero cannot be rejected ($p > 0.10$), confirming that randomly assigned O&G exposure generates no systematic effects on any outcome variable.

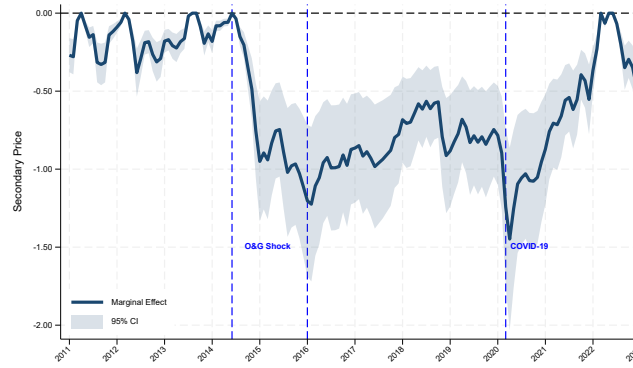
Figure B.6: Marginal Effects of O&G Exposure Over Time



(a) ID Test Ratio



(b) Transaction Amount



(c) Secondary Loan Price

Notes: This figure plots the time-varying marginal effect of a one percentage point increase in firm O&G exposure on three outcomes. Each panel shows $\frac{\partial Y}{\partial \text{O\&G Share}} = \beta_1 + \beta_2 \times \text{Oil Decline}_t$, where coefficients come from the regression specification: $Y_{i,t} = \beta_0 + \beta_1 \text{O\&G Share}_f + \beta_2 \text{Oil Decline}_t + \beta_3 (\text{O\&G Share}_f \times \text{Oil Decline}_t) + \alpha_i + \alpha_t + \epsilon_{i,t}$ where Oil Decline_t measures the dollar decline in WTI crude oil price from the June 2014 baseline: $\text{Oil Decline}_t = \text{Max}(0, \$105.79 - \text{WTI Price}_t)$. By December 2014, oil had declined \$46.50/barrel. The marginal effect is scaled to represent a 1 percentage point increase in O&G exposure by dividing regression coefficients by 100. Appendix Figures B.6a, B.6b, B.6c show effects on CLO covenant distance, measured as $\ln(\text{ID test result} / \text{threshold})$, transaction amounts (face value in \$ millions), and secondary loan prices (per \$100 par), respectively. Negative values indicate sales. Shaded areas represent 95% confidence intervals. Vertical dashed lines mark the O&G shock period and COVID-19 shock. The specification for Appendix Figure B.6b includes deal and month-year fixed effects with standard errors clustered by CLO and month-year. Appendix Figures B.6c and B.6 include issuer-loan type, month-year, and currency fixed effects with standard errors clustered by CLO $\times$ issuer and transaction date.

Table B.1: Interest Diversion Threshold and O&G Exposure

$\ln(\text{ID Threshold})$	(1)	(2)	(3)	(4)
O&G Share	-0.3075 (0.3469)	-0.2474 (0.4429)	-0.3873 (0.4175)	-0.1486 (0.2594)
CLO Controls	✓	✓	✓	✓
Manager FE	✓	✓	✓	✓
Arranger FE				✓
Trustee FE				✓
Year FE		✓		
Month-Year FE			✓	✓
N	66	66	66	66
R^2	0.5904	0.6251	0.8227	0.9698

Notes: The table presents the relation between CLO O&G exposure and the natural log of the Interest Diversion (ID) covenant threshold before the shock occurs. The regression specification is: $Y_{c,t} = \beta_0 + \beta_1(\text{CLO O\&G Exposure})_c + \gamma'_0 X_c + \alpha_t + \alpha_a + \alpha_m + \alpha_e + \epsilon_{c,t}$ where $Y_{c,t}$ is the Interest Diversion covenant threshold of CLO c , measured as the most recently reported value at time t prior to the shock, a denotes the CLO arranger, m denotes the CLO manager, e denotes the CLO trustee, and X_c denotes the vector of controls, consisting of current CLO age (Columns 1-4), CLO size (Columns 2-4), CCC-share and defaulted-share (Columns 3-4). CLO O&G Exposure _{c} (labeled "O&G Share" in the table) is the O&G share of CLO c measured when the CLO is first reported in the sample. There is one observation per CLO. Standard errors are robust.

Table B.2: CLO Comparison based on Observable Firm Characteristics

Low O&G Exposure	N	Q1	Median	Q3	Mean	Std. Dev.
Size	2,390	7.2432	8.3261	9.2797	8.2723	1.3328
Age (Years)	1,645	1.4000	5.3810	10.4000	5.8202	4.8005
ln(CapEx)	2,377	2.8019	3.8516	5.0407	3.9011	1.7660
Investment-Capital Ratio	2,373	-0.0021	0.0065	0.0213	0.0137	0.0347
Leverage	2,385	0.3492	0.5085	0.7150	0.5619	0.2970
Long-term Debt Growth	2,268	-0.0066	0.0079	0.0348	0.0121	0.0467
Cash Flow	2,307	0.0161	0.0193	0.0269	0.0211	0.0123
Sales Growth	2,363	0.0041	0.0157	0.0316	0.0251	0.0607
Acquisitions	2,286	0.0000	0.0047	0.0160	0.0133	0.0216
R&D Growth	676	-0.0324	0.0087	0.0184	-0.0244	0.0828
High O&G Exposure	N	Q1	Median	Q3	Mean	Std. Dev.
Size	7,164	7.0834	8.2781	9.2797	8.1796	1.3565
Age (Years)	4,981	1.2727	5.2727	10.2727	5.4101	4.8313
ln(CapEx)	7,080	2.6516	3.7977	4.8768	3.8298	1.7709
Investment-Capital Ratio	7,063	-0.0016	0.0088	0.0256	0.0161	0.0365
Leverage	7,142	0.3492	0.5045	0.6982	0.5515	0.3154
Long-term Debt Growth	6,798	-0.0060	0.0102	0.0379	0.0173	0.0581
Cash Flow	6,876	0.0159	0.0193	0.0269	0.0209	0.0129
Sales Growth	7,074	0.0035	0.0172	0.0371	0.0265	0.0596
Acquisitions	6,809	0.0001	0.0067	0.0223	0.0163	0.0278
R&D Growth	2,083	-0.0324	-0.0005	0.0184	-0.0166	0.0651

Notes: This table compares characteristics of firms with high CLO O&G exposure to firms with low CLO O&G exposure, before the shock. CLOs with above-median O&G exposure have *high* O&G exposure while CLOs with below-median O&G exposure have *low* O&G exposure. The characteristics of interest are: size, age, capital expenditure, investment-capital ratio, leverage, long-term debt growth, cash flow, sales growth, acquisitions, and R&D growth. The number of observations, first quartile, median, third quartile, mean, and standard deviation associated with each variable are in Columns 2-7, respectively.

Table B.3: CLO Selection by Covariance of Oil Price and Firm Profitability

	$\mathbb{1}_{\text{High CLO O\&G Share}}$			
	(1)	(2)	(3)	(4)
Covariance(Oil Price, Firm Profitability)	-0.7544 (3.3693)	-0.8338 (1.1698)	-3.9743 (3.7136)	-0.1699 (0.6699)
Constant	0.7642*** (0.0249)			
CLO Controls			✓	✓
Issuer Controls				✓
Manager-Arranger-Trustee FE				✓
Rating-Industry FE			✓	✓
Manager FE		✓		
Year FE		✓	✓	
Month-Year FE				✓
<i>N</i>	5,029	5,029	5,029	5,029
<i>R</i> ²	0.0000	0.3302	0.2170	0.9075

Notes: The table presents the relation between the covariance of firm profitability and oil price, and, an indicator of whether the CLO portfolio that holds firm f has a high share of O&G before the shock occurs. CLOs with above-median O&G exposure have *High* O&G exposure. The regression specification is: $\mathbb{1}_{(f \in c \text{ with high O\&G exposure})_{c,f}} = \alpha + \beta(\text{Covariance(Oil Price, Profitability)})_f + \gamma_0 X_c + \gamma_1 Z_f + \alpha_t + \epsilon_{c,f}$ where $\mathbb{1}_{(f \in c \text{ with high O\&G exposure})_{c,f}}$ indicates whether firm f is held in a CLO c with high O&G exposure, f denotes the portfolio firm ($f \in c$), t denotes the time, X_c is a vector of CLO controls and Z is a vector of issuer controls. CLO controls include size, age, CCC-share and defaulted-share (Columns 3, 5). Issuer controls include size, capital expenditure, leverage, cash flow, and sales growth (Columns 4-5). Standard errors are two-way clustered by CLO and issuer.

Table B.4: CLO Covenant Pressure and O&G Exposure: 2009-2019

$\ln\left(\frac{\text{Test Result}}{\text{Covenant Threshold}}\right)$	Panel A: Distance to ID Threshold					
	(1)	(2)	(3)	(4)	(5)	(6)
O&G Share $\times$ Post	-0.7849*** (0.1754)	-0.4338*** (0.1327)	-0.3693*** (0.0995)	-0.3561*** (0.1016)	-0.3805*** (0.1065)	-0.3667*** (0.1078)
O&G Share	0.4324 (0.2774)	0.2799* (0.1679)	0.2203 (0.1423)	0.2776** (0.1230)		
Post	0.0462*** (0.0087)	0.0112* (0.0057)			0.0111** (0.0049)	
CLO Controls		✓	✓	✓		
CLO FE					✓	✓
Manager FE	✓	✓	✓	✓		
Year FE		✓			✓	
Month-Year FE			✓	✓		✓
<i>N</i>	4,903	4,903	4,903	4,903	4,903	4,903
<i>R</i> ²	0.3306	0.4406	0.4558	0.4664	0.6255	0.6352
$\mathbb{1}_{Fail}$	Panel B: ID Covenant Violation					
	(1)	(2)	(3)	(4)	(5)	(6)
O&G Share $\times$ Post	3.1316*** (0.7533)	1.7670*** (0.4959)	1.1969*** (0.3941)	1.1288*** (0.4100)	1.2854*** (0.4130)	1.2950*** (0.4060)
O&G Share	-4.7432*** (1.4042)	-2.1267*** (0.7656)	-1.4302* (0.8435)	-1.6277* (0.8840)		
Post	-0.1579*** (0.0343)	-0.0504*** (0.0143)			-0.0332*** (0.0125)	
CLO Controls		✓	✓	✓		
CLO FE					✓	✓
Manager FE	✓	✓	✓	✓		
Year FE		✓			✓	
Month-Year FE			✓	✓		✓
<i>N</i>	4,903	4,903	4,903	4,903	4,903	4,903
<i>R</i> ²	0.2345	0.3638	0.4123	0.4187	0.5017	0.5379

Notes: The table examines the relation between CLO O&G exposure and covenant pressure over the period 2009-2019. Panel A uses the log distance to the Interest Diversion covenant threshold as the dependent variable, measured as $\ln(\text{Test Result}/\text{Covenant Threshold})$. Panel B uses an indicator for covenant violation (distance < 1.0) as the dependent variable. The regression specification is $Y_{c,t} = \beta_0 + \beta_1(\text{CLO O\&G Exposure})_c + \beta_2(\text{Post})_t + \beta_3(\text{CLO O\&G Exposure}_c \times \text{Post}_t) + \gamma'_0 X_c + \alpha_c + \alpha_t + \epsilon_{c,t}$ where $Y_{c,t}$ is the covenant distance (Panel A) or violation indicator (Panel B) for CLO c at time t . CLO O&G Exposure is measured as of May 2014 (pre-shock), calculated as the value-weighted share of CLO holdings allocated to O&G borrowers. Post equals one after June 2014. CLO Controls include CLO age (Columns 2-6), CLO size measured as log principal balance (Columns 3-6), share of CCC-rated loans, and share of defaulted loans (Columns 4 and 6). Columns 1-4 include manager fixed effects; Columns 5-6 include CLO fixed effects. Standard errors are two-way clustered by CLO and month-year.

Table B.5: CLO-Level Trading Effects

	Transaction Amount (\$ mn)					
	(1)	(2)	(3)	(4)	(5)	(6)
O&G Share $\times$ Post	-21.6305*** (3.9353)	-21.5070*** (3.9990)	-20.6993*** (3.8396)	-18.6094*** (4.2161)	-19.0013*** (4.3387)	-32.5076*** (7.2586)
O&G Share	13.6202*** (3.3401)	13.5009*** (3.4149)	13.7480*** (3.1630)	15.3415*** (4.0040)		
Post	0.1100 (0.1332)	0.2832* (0.1528)			0.1569 (0.1652)	
Manager FE			✓			
Rating-Industry FE				✓		
Issuer FE					✓	
CLO-Issuer FE						✓
Year FE		✓			✓	
Month-Year FE			✓	✓		✓
<i>N</i>	52,211	52,211	52,211	52,211	52,211	52,211
<i>R</i> ²	0.0121	0.0136	0.0442	0.0414	0.0623	0.4269

Notes: The table presents the relation between firm O&G exposure and net transaction amount for non-O&G firms. The regression specification is: $Y_{c,f,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure})_f + \beta_2(\text{Post})_t + \beta_3(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \gamma_0 Z_f + \alpha_{c,f} + \alpha_t + \epsilon_{c,f,t}$. $Y_{c,f,t}$ is the net transaction amount of firm f by CLO c at time t (f), and Z is a vector of firm controls including rating and industry. Firm O&G Exposure _{f} (labeled “O&G Share” in the table) measures the value-weighted average O&G share across all CLOs holding firm f ’s debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by issuer and month-year.

Table B.6: Issuer-Level Trading Effects

	Transaction Amount (\$ mn)				
	(1)	(2)	(3)	(4)	(5)
O&G Share $\times$ Post	-95.8462*** (26.2995)	-95.4423*** (25.9980)	-86.2444*** (27.9809)	-67.1475* (35.1166)	-71.4915** (35.0057)
O&G Share	58.8115** (23.2905)	58.8819** (22.8091)	50.8740** (24.5047)		
Post	1.9572* (1.0063)	1.4534 (1.0454)		0.5601 (1.2796)	
Issuer FE				✓	✓
Rating-Industry FE			✓		
Year FE		✓		✓	
Month-Year FE			✓		✓
<i>N</i>	11,036	11,036	11,036	11,036	11,036
<i>R</i> ²	0.0009	0.0011	0.0362	0.0774	0.0849

Notes: The table presents the relation between firm O&G exposure and net transaction amount for non-O&G firms. The regression specification is: $Y_{f,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure})_f + \beta_2(\text{Post})_t + \beta_3(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \gamma_0 Z_f + \alpha_f + \alpha_t + \epsilon_{f,t}$. $Y_{f,t}$ is the net transaction amount of firm f across all CLOs c at time t (f), and Z is a vector of firm controls including rating and industry. Firm O&G Exposure _{f} (labeled “O&G Share” in the table) measures the value-weighted average O&G share across all CLOs holding firm f ’s debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by issuer and month-year.

Table B.7: Issuer-Level Effects by Transaction Type

	Transaction Amount (\$ mn)					
	Purchases			Sales		
	(1)	(2)	(3)	(4)	(5)	(6)
O&G Share $\times$ Post	9.5680 (53.9782)	41.3923 (65.7839)	26.1959 (63.4950)	117.6805*** (34.4770)	136.3471*** (42.4549)	122.1907*** (40.0693)
O&G Share	-143.2491*** (48.3649)			-193.2717*** (37.9378)		
Post		-3.9390 (2.6491)			-5.1911*** (1.8116)	
Rating-Industry FE	✓			✓		
Issuer FE		✓	✓		✓	✓
Year FE		✓			✓	
Month-Year FE	✓		✓	✓		✓
<i>N</i>	8,526	8,526	8,526	8,068	8,068	8,068
<i>R</i> ²	0.0676	0.1335	0.1493	0.0962	0.1800	0.2036

Notes: The table presents the relation between firm O&G exposure and total purchases in millions of dollars (columns 1-3) and sales in millions of dollars (columns 4-6) for non-O&G firms. The regression specification is: $Y_{f,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \beta_2(\text{Post})_t + \gamma_0 Z_f + \alpha_f + \alpha_t + \epsilon_{f,t}$ where $Y_{c,f,t}$ is the total transaction amount of firm f across all CLOs c at time t (f), and Z is a vector of firm controls including rating and industry. Firm O&G Exposure $_f$ (labeled “O&G Share” in the table) measures the value-weighted average O&G share across all CLOs holding firm f ’s debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by issuer and month-year.

Table B.8: Primary Institutional Loan Maturity and O&G Exposure

Maturity (Months)	(1)	(2)	(3)	(4)	(5)
O&G Share $\times$ Post	-418.8758** (166.3351)	-410.7880** (169.7268)	-406.1509** (172.7002)	-376.8414* (200.4208)	-455.7650** (178.8450)
Post	13.3268** (5.2230)	13.8982* (7.1315)	12.6951* (6.9838)	12.0573 (7.6664)	
Issuer FE	✓	✓			
Loan Type FE	✓	✓			
Issuer-Loan Type FE			✓	✓	✓
Secured FE		✓	✓	✓	✓
Purpose FE				✓	✓
Distribution Method FE				✓	✓
Seniority FE			✓	✓	✓
Country of Syndication FE				✓	✓
Year FE		✓	✓	✓	
Month-Year FE					✓
Currency FE	✓	✓	✓	✓	✓
N	513	513	513	513	513
R ²	0.5961	0.5974	0.6184	0.6665	0.7133

Notes: The table presents the relation between firm O&G exposure and primary loan maturity for non-O&G firms. The regression specification is: $Y_{i,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \beta_2(\text{Post})_t + \gamma_0 X_i + \alpha_t + \alpha_{f,l} + \epsilon_{i,t}$ where $Y_{i,t}$ is the maturity in months of loan i at time t , of loan type l , issued by firm f ($i \in f$), and X_i is the vector of non-time varying controls associated with loan i including secured status, purpose, distribution method, seniority, currency and country of syndication. Firm O&G Exposure _{f} (labeled "O&G Share" in the table) measures the value-weighted average O&G share across all CLOs holding firm f 's debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by issuer and month-year.

Table B.9: Primary Institutional Loan Amount and O&G Exposure

ln(Loan Amount)	(1)	(2)	(3)	(4)	(5)
O&G Share $\times$ Post	-8.6964 (7.2299)	-8.6127 (7.1540)	-8.2966 (7.1399)	-6.8979 (6.1675)	-6.5803 (6.6498)
Post	0.0654 (0.2567)	0.2187 (0.3323)	0.1587 (0.3436)	0.1995 (0.3006)	
Maturity				0.0178*** (0.0032)	0.0186*** (0.0031)
Issuer FE	✓	✓			
Loan Type FE	✓	✓			
Issuer-Loan Type FE			✓	✓	✓
Secured FE		✓	✓	✓	✓
Purpose FE				✓	✓
Distribution Method FE				✓	✓
Seniority FE			✓	✓	✓
Country of Syndication FE				✓	✓
Year FE		✓	✓	✓	
Month-Year FE					✓
Currency FE	✓	✓	✓	✓	✓
N	513	513	513	513	513
R^2	0.6137	0.6155	0.6245	0.6975	0.7183

Notes: The table presents the relation between firm O&G exposure and primary loan amount for non-O&G firms. The regression specification is: $Y_{i,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \beta_2(\text{Post})_t + \beta_3\text{Maturity}_{i,t} + \gamma_0 X_i + \alpha_t + \alpha_{f,l} + \epsilon_{i,t}$ where $Y_{i,t}$ is the loan amount ($\ln(\text{loan amount})$) of loan i at time t , of loan type l , issued by firm f ($i \in f$), and X_i is the vector of non-time varying controls associated with loan i including secured status, purpose, distribution method, seniority, currency and country of syndication. Firm O&G Exposure $_f$ (labeled “O&G Share” in the table) measures the value-weighted average O&G share across all CLOs holding firm f ’s debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by issuer and month-year.

Table B.10: Bond Credit Spread and O&G Exposure

Bond Credit Spread	(1)	(2)	(3)	(4)	(5)
O&G Share $\times$ Post	3160.2456*	3167.5360*	3278.2291*	2432.5528*	2407.3679*
	(1619.9895)	(1616.0870)	(1661.9927)	(1288.0784)	(1284.2039)
Post	-30.1414	-31.9794	-33.5413	-11.4341	
	(33.1831)	(39.0225)	(38.7291)	(27.8727)	
Time to Maturity				4.5149***	4.5907***
				(1.0078)	(0.9985)
Issuer FE	✓	✓			
Bond Type FE	✓	✓			
Issuer-Bond Type FE			✓	✓	✓
Security Level FE			✓	✓	✓
Rating FE				✓	✓
IG FE				✓	✓
Defaulted FE				✓	✓
Year FE		✓	✓	✓	
Month-Year FE					✓
N	9,876	9,876	9,876	9,876	9,876
R ²	0.5211	0.5297	0.5663	0.6911	0.6979

Notes: The table presents the relation between firm O&G exposure and bond credit spread for non-O&G firms. Bond credit spread is measured relative to a treasury with corresponding maturity. The regression specification is: $Y_{i,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t)_f + \beta_2(\text{Post})_t + \beta_3\text{Time to Maturity} + \gamma_0 X_{i,t} + \alpha_{f,b} + \alpha_t + \epsilon_{i,t}$ where $Y_{i,t}$ is the bond credit spread (%) of bond i at time t , of bond type b , issued by firm f ($i \in f$), and $X_{i,t}$ is the vector of controls associated with bond i including security level, rating, investment-grade indicator, and defaulted status. Firm O&G Exposure _{f} (labeled “O&G Share” in the table) measures the value-weighted average O&G share across all CLOs holding firm f ’s debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by issuer and month-year.

Table B.11: Bond Liquidity and O&G Exposure

Bond Liquidity	(1)	(2)	(3)	(4)	(5)
O&G Share $\times$ Post	1.9006** (0.9023)	1.9044** (0.8943)	2.0690** (0.9378)	2.0969** (0.8108)	2.0997** (0.8117)
Post	-0.0489** (0.0210)	-0.0340 (0.0226)	-0.0369 (0.0233)	-0.0329 (0.0224)	
Time to Maturity				0.0228*** (0.0034)	0.0228*** (0.0034)
Issuer FE	✓	✓			
Bond Type FE	✓	✓			
Issuer-Bond Type FE			✓	✓	✓
Security Level FE			✓	✓	✓
Rating FE				✓	✓
IG FE				✓	✓
Defaulted FE				✓	✓
Year FE		✓	✓	✓	
Month-Year FE					✓
N	9,955	9,955	9,955	9,955	9,955
R ²	0.2739	0.2767	0.2919	0.3861	0.3926

Notes: The table presents the relation between firm O&G exposure and bond liquidity for non-O&G firms. The regression specification is: $Y_{i,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \beta_2(\text{Post})_t + \beta_3\text{Time to Maturity}_{i,t} + \gamma_0 X_{i,t} + \alpha_{f,b} + \alpha_t + \epsilon_{i,t}$ where $Y_{i,t}$ is the bond liquidity in % of bond i at time t , of bond type b , issued by firm f ($i \in f$), and $X_{i,t}$ is the vector of controls associated with bond i including bond type, security level, rating, investment-grade indicator, and defaulted status. Bond liquidity is defined as the average bid-ask spread. Firm O&G Exposure _{f} (labeled “O&G Share” in the table) measures the value-weighted average O&G share across all CLOs holding firm f ’s debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by issuer and month-year.

Table B.12: CLO Defaulted Share and O&G Exposure

	Distressed Share			
	(1)	(2)	(3)	(4)
O&G Share $\times$ Post	-0.1943*** (0.0674)	-0.2378** (0.1168)	-0.2320* (0.1162)	-0.2270* (0.1147)
Post	0.00556 (0.0060)	0.0299*** (0.0062)	0.0172** (0.0067)	
O&G Share	-0.3887* (0.2088)			
CLO FE		✓	✓	✓
Year FE			✓	
Month-Year FE				✓
N	11,760	11,760	11,760	11,760
R^2	0.0146	0.6628	0.6642	0.6665

Notes: The table presents the relation between CLO O&G exposure and share of distressed loans. Distressed loans refer to loans that are reported as “defaulted” by the CLO, which can include payment defaults and covenant breaches. The regression specification is: $Y_{c,t} = \beta_0 + \beta_1(\text{CLO O\&G Exposure})_c + \beta_2(\text{Post})_t + \beta_3(\text{CLO O\&G Exposure}_c \times \text{Post}_t) + \alpha_c + \alpha_t + \epsilon_{c,t}$ where $Y_{c,t}$ is the share of distressed loans in CLO c at time t . CLO O&G Exposure _{c} (labeled “O&G Share” in the table) is the O&G share of CLO c before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by CLO and month-year.

Table B.13: CLO-Level IV: Covenant Pressure and Portfolio Liquidations

	(1) First Stage	(2)	(3)	(4)
	ID Test Ratio	ln(Holdings)		
ln(ID Test Ratio)		18.6295*** (6.0662)	10.0175** (3.7966)	10.8057** (4.0796)
O&G Share $\times$ Post	-0.1701*** (0.0566)			
Deal FE	✓	✓	✓	✓
Month-Year FE		✓	✓	
Issuer FE			✓	
Issuer $\times$ Month-Year FE	✓			✓
Observations	325,769	325,769	325,769	325,769
Kleibergen-Paap LM	6.6929			
Kleibergen-Paap Wald F	9.0348			

Notes: This table presents two-stage least squares (2SLS) estimates of the causal effect of CLO covenant pressure on portfolio liquidations of non-O&G firms. The sample consists of CLO holdings aggregated to the deal-issuer-month level during 2013-2015, excluding all O&G sector firms. Column 1 reports the first-stage regression: $\ln(\text{ID Test Ratio}_{c,t}) = \gamma_0 + \gamma_1(\text{CLO O\&G Share}_c \times \text{Post}_t) + \alpha_c + \alpha_{f,t} + u_{c,t}$ where c indexes CLO deals, f indexes issuers (firms), and t denotes month-year. The ID Test Ratio measures natural log of the distance to the Interest Diversion covenant threshold, calculated as $\ln(\text{Test Result}/\text{Covenant Threshold})$, with lower values indicating tighter constraints. CLO O&G Share _{c} is CLO c 's pre-shock exposure to the O&G sector. Post equals 1 after June 2014. Columns 2-4 report second-stage IV regressions: $\ln(\text{Holdings}_{c,f,t}) = \beta_0 + \beta_1 \widehat{\ln(\text{ID Test Ratio}_{c,t})} + \alpha_c + \alpha_{f,t} + \epsilon_{c,f,t}$. The coefficient β_1 measures the elasticity of portfolio liquidations with respect to covenant pressure. Standard errors are two-way clustered by CLO deal and month-year.

Table B.14: Covenant Distance Heterogeneity: Split-Sample Estimates

	Transaction Amount (\$mn)		Secondary Loan Price (\$/\$100)		Investment-Capital Ratio	
	Loose Covenants	Tight Covenants	Loose Covenants	Tight Covenants	Loose Covenants	Tight Covenants
	(1)	(2)	(3)	(4)	(5)	(6)
O&G Share $\times$ Post	-13.5364*** (2.6778)	-16.2629*** (4.3762)	-0.6313 (30.6993)	-65.5133** (32.6139)	-0.2042 (0.4395)	-0.8751** (0.3932)
Issuer-Loan Type FE	✓	✓	✓	✓		
Issuer FE					✓	✓
Month-Year FE	✓	✓	✓	✓		
Quarter-Year FE					✓	✓
Currency FE	✓	✓	✓	✓		
N	46,501	83,288	46,507	83,299	799	1,124
R^2	0.1132	0.0627	0.6604	0.2771	0.2393	0.1798

Notes: This table presents split-sample regression estimates corresponding to Figure 10. The sample is divided based on firm-level pre-shock covenant distance, measured as the weighted average covenant distance across all CLOs holding the firm's debt. Loose covenants (above-median) include firms whose CLO lenders had covenant distance above the median; tight covenants (below-median) include firms whose CLO lenders operated closer to covenant thresholds. The regression specification is:

$$Y_{i,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \gamma_0 Z_i + \alpha_{i,l} + \alpha_t + \epsilon_{i,t}$$

where $Y_{i,t}$ is the transaction amount in columns 1 and 2 and secondary loan price in columns 3 and 4 of loan i at time t issued by firm f . Z_i includes a currency control, and l denotes the loan-type.

$$Y_{f,t} = \beta_0 + \beta_1(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \alpha_f + \alpha_t + \epsilon_{i,t}$$

where $Y_{f,t}$ is the investment capital ratio in columns 5 and 6. Firm O&G Exposure measures the weighted average O&G share across all CLOs holding the firm's debt as of May 2014. Post equals one after June 2014. The coefficient of interest, O&G Share $\times$ Post, captures the differential effect of O&G exposure on firm outcomes following the oil price shock. Specifications include issuer-loan type fixed effects in columns 1-4, issuer fixed effects in columns 5-6, month-year fixed effects in columns 1-4, quarter-year fixed effects in columns 5-6, and currency fixed effects in columns 1-4. Standard errors (in parentheses) are two-way clustered by CLO $\times$ issuer and trade date in columns 1-4 and by issuer in columns 5-6.

Table B.15: Reduced Form: O&G Exposure and Changes in CLO Holdings

$\Delta \ln(\text{Holdings})$	(1)	(2)	(3)	(4)
O&G Share $\times$ Post	-3.2347*	-3.3654**	-3.5405**	-3.7038**
	(1.6377)	(1.6125)	(1.6466)	(1.6607)
Post	0.0427	0.0999		
	(0.0466)	(0.0784)		
Firm FE	✓	✓	✓	✓
Year FE		✓		
Month-Year FE			✓	
Industry $\times$ Month-Year FE				✓
Observations	12,008	12,008	12,008	12,008
R^2	0.0861	0.0885	0.2152	0.2856

Notes: This table presents reduced-form estimates of the effect of firm O&G exposure on changes in CLO holdings. The specification is:

$$\Delta \ln(\text{Holdings}_{f,t}) = \beta_0 + \beta_1(\text{O\&G Exposure}_f \times \text{Post}_t) + \beta_2 \text{Post}_t + \alpha_f + \alpha_{i,t} + \epsilon_{f,t}$$

where i denotes the industry, $\text{O\&G Exposure}_f$ is the value-weighted average share of O&G loans across all CLOs holding firm f 's debt, measured in May 2014 (pre-shock). Post takes a value of 1 after the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by issuer and month-year.

Table B.16: Heterogeneous Effects by Firm CLO Dependence

$\Delta \ln(\text{Holdings})$	(1)	(2)	(3)	(4)
CLO Dependence $\times$ O&G Share $\times$ Post	-2.6880* (1.4538)	-2.6740* (1.3213)	-2.6801* (1.3344)	-2.5585** (1.1844)
CLO Dependence $\times$ Post	0.0813** (0.0357)	0.0811** (0.0310)	0.0819** (0.0317)	0.0793** (0.0302)
O&G Share $\times$ Post	-0.5024 (0.6714)	-0.5251 (1.4330)	-0.6238 (1.4283)	-0.7371 (1.4046)
Post	-0.0022 (0.0167)	0.0237 (0.0635)		
Issuer FE	✓	✓	✓	✓
Year FE		✓		
Month-Year FE			✓	
Industry $\times$ Month-Year FE				✓
Observations	20,463	20,463	20,463	20,463
R^2	0.0431	0.0436	0.1006	0.1597

Notes: This table examines how the effect of O&G exposure on CLO fire sales varies with firm dependence on CLO financing. The specification is:

$$\begin{aligned}
\Delta \ln(\text{Holdings}_{f,t}) = & \beta_0 + \beta_1(\text{CLO Dep}_f \times \text{O\&G Exp}_f \times \text{Post}_t) \\
& + \beta_2(\text{CLO Dep}_f \times \text{Post}_t) + \beta_3(\text{O\&G Exp}_f \times \text{Post}_t) \\
& + \beta_4 \text{Post}_t + \alpha_f + \alpha_{i,t} + \epsilon_{f,t}
\end{aligned}$$

CLO Dependence is measured as the share of a firm's total institutional term loans held in CLO portfolios (pre-shock), standardized to mean zero and unit standard deviation. Higher values indicate firms more reliant on CLO financing. O&G Exposure is the value-weighted average share of O&G loans across all CLOs holding firm f 's debt, measured in May 2014 (pre-shock). i denotes the industry. Standard errors are two-way clustered by issuer and month-year.

Table B.17: Exploiting the 7.5% CCC Threshold: Alternative Exposure Measures

	Panel A: Sale Amount (\$mn)			
	(1) High-CCC Only	(2) CCC Distance	(3) CCC Excess	(4) CCC Share
CCC Measure $\times$ Post	93.8707*** (27.7656)	7.9527*** (1.9254)	21.7684*** (6.0686)	1.9002*** (0.5723)
Issuer-Loan Type FE	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓
N	56,095	56,095	56,095	56,095
R^2	0.2681	0.2685	0.2681	0.2683
	Panel B: Secondary Loan Price (per \$100 par)			
	(1) High-CCC Only	(2) CCC Distance	(3) CCC Excess	(4) CCC Share
CCC Measure $\times$ Post	-1233.0546*** (415.1968)	-36.9388* (21.1330)	-255.6393** (117.1604)	-16.8469** (6.6878)
Issuer-Loan Type FE	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓
N	56,102	56,102	56,102	56,102
R^2	0.6065	0.6059	0.6063	0.6062

Notes: This table tests the 7.5% CCC covenant threshold using alternative firm-level exposure measures. The dependent variable in Panel A is the sale amount (in millions of dollars). The dependent variable in Panel B is the secondary loan price (per \$100 of par). The sample includes sales transactions from non-O&G firms within 5 percentage points of the 7.5% threshold during 2013-2015. To ensure common support, I restrict to firms borrowing from CLOs with O&G exposure between the 25th and 75th percentiles. The results remain robust when these restrictions are relaxed. Post is an indicator equal to 1 after June 2014. All CCC exposure measures are calculated pre-shock (before June 2014) as value-weighted averages across CLOs holding each firm's debt. Column 1: O&G Exposure calculated *only* from CLOs with CCC share $\geq 7.5\%$ (High-CCC Only = $\sum_c w_c \times \text{O\&G Share}_c \times \mathbb{1}[\text{CCC Share}_c \geq 0.075]$); Column 2: Firm's weighted average distance from the 7.5% threshold (CCC Distance = $\sum_c w_c \times (\text{CCC Share}_c - 0.075)$); Column (3): Firm's weighted average *excess* CCC holdings above 7.5% (CCC Excess = $\sum_c w_c \times \max(0, \text{CCC Share}_c - 0.075)$); Column (4): Share of firm debt held by CLOs with CCC share $\geq 7.5\%$ (CCC Share = $\sum_c w_c \times \mathbb{1}[\text{CCC Share}_c \geq 0.075]$). All specifications include issuer-loan type and month-year fixed effects and are restricted to sales transactions. Standard errors are two-way clustered by CLO $\times$ issuer and trade date.

Table B.18: Falsification Test: Primary Non-Institutional Loan Spread and O&G Exposure

	All-in-Drawn Spread				
	(1)	(2)	(3)	(4)	(5)
O&G Share $\times$ Post	371.1692 (248.9200)	304.2327 (252.3536)	310.1660 (251.4295)	226.3725 (206.5975)	-140.3541 (225.6863)
Post	-38.0206*** (10.6312)	-14.4615 (15.0827)	-15.1705 (15.1755)	-10.9200 (14.7855)	
Maturity				-1.5374*** (0.4526)	-0.9770*** (0.3503)
Issuer FE	✓	✓			
Loan Type FE	✓	✓			
Issuer-Loan Type FE			✓	✓	✓
Secured FE		✓	✓	✓	✓
Purpose FE				✓	✓
Distribution Method FE				✓	✓
Seniority FE			✓	✓	✓
Country of Syndication FE				✓	✓
Year FE		✓	✓	✓	
Month-Year FE					✓
Currency FE	✓	✓	✓	✓	✓
N	347	347	347	347	347
R^2	0.8941	0.9000	0.9006	0.9141	0.9409

Notes: The table presents the relation between firm O&G exposure and primary non-institutional loan spread for non-O&G firms. The regression specification is: $Y_{i,t} = \beta_0 + \beta_1(\text{Post})_t + \beta_2(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \beta_3\text{Maturity}_{i,t} + \gamma_0 X_i + \alpha_t + \alpha_f + \epsilon_{i,t}$ where $Y_{i,t}$ is the all-in-drawn spread of loan i at time t issued by firm f ($i \in f$), and X_i is the vector of non-time varying controls associated with loan i including secured status, purpose, distribution method, seniority, loan type, currency, and country of syndication. Firm O&G Exposure $_f$ (labeled "O&G Share" in the table) measures the value-weighted average O&G share across all CLOs holding firm f 's debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by issuer and month-year.

Table B.19: Falsification Test: Primary Revolving Credit Undrawn Spread and O&G Exposure

	All-in-Undrawn Spread				
	(1)	(2)	(3)	(4)	(5)
O&G Share $\times$ Post	21.6797 (42.6808)	-1.5194 (43.0084)	-1.5194 (42.8894)	-6.7756 (43.4886)	89.2444 (90.0033)
Post	-4.5477*** (1.6102)	1.0591 (2.3330)	1.0591 (2.3265)	1.0947 (2.3630)	
Maturity				-0.1223 (0.0848)	-0.1434 (0.1415)
Issuer FE	✓	✓			
Loan Type FE	✓	✓			
Issuer-Loan Type FE			✓	✓	✓
Secured FE		✓	✓	✓	✓
Purpose FE				✓	✓
Distribution Method FE				✓	✓
Seniority FE			✓	✓	✓
Country of Syndication FE				✓	✓
Year FE		✓	✓	✓	
Month-Year FE					✓
Currency FE	✓	✓	✓	✓	✓
N	190	190	190	190	190
R ²	0.8729	0.8846	0.8846	0.8865	0.9278

Notes: This table presents the relation between firm O&G exposure and primary undrawn spread associated with revolving credit facilities for non-O&G firms. The regression specification is: $Y_{i,t} = \beta_0 + \beta_1(\text{Post})_t + \beta_2(\text{Firm O\&G Exposure}_f \times \text{Post}_t) + \beta_3\text{Maturity}_{i,t} + \gamma_0 X_i + \alpha_t + \alpha_f + \epsilon_{i,t}$ where $Y_{i,t}$ is the all-in-undrawn spread of facility i at time t issued by firm f ($i \in f$), and X_i is the vector of non-time varying controls associated with facility i including secured status, purpose, distribution method, seniority, loan type, currency, and country of syndication. Firm O&G Exposure _{f} (labeled "O&G Share" in the table) measures the value-weighted average O&G share across all CLOs holding firm f 's debt before the shock occurs, while Post is an indicator variable that takes a value of 1 if the O&G price plunge has occurred, and 0 otherwise. Standard errors are two-way clustered by issuer and month-year.

Table B.20: Correlation Matrix: Alternative O&G Exposure Measures

	(1)	(2)	(3)	(4)	(5)
	Volume	Log	Count	Binary	Equal
	Weights	Weights	Weights	Exposure	Weights
(1) Volume Weights	1.000				
(2) Log Weights	0.9899	1.000			
(3) Count Weights	0.9562	0.9671	1.000		
(4) Binary Exposure	0.9854	0.9970	0.9676	1.000	
(5) Equal Weights	0.9588	0.9698	0.9974	0.9703	1.000

Notes: This table presents pairwise correlations between alternative constructions of firm-level O&G exposure. All measures aggregate CLO-level O&G portfolio shares to the firm level using different weighting schemes. Sample includes all non-O&G firms held by CLOs with available data as of May 2014 (pre-shock). $N = 6,638$.

- **Volume Weights (Baseline):** $\omega_{f,c} = \text{Holdings}_{f,c} / \sum_c \text{Holdings}_{f,c}$ – the dollar share of firm f 's total CLO debt held by CLO c
- **Log Weights:** $\omega_{f,c} = \ln(\text{Holdings}_{f,c}) / \sum_c \ln(\text{Holdings}_{f,c})$
- **Equal Weights:** $\omega_{f,c} = 1/N_f$ where N_f is the number of CLOs holding firm f 's debt – equal weight across all lenders regardless of position size.
- **Count Weights:** Weight by the number of loans rather than dollar volume – $\omega_{f,c}$ is the share of firm f 's loans (not dollars) held by CLO c .
- **Binary Exposure:** $\text{Exposure}_f = \sum_c \mathbb{1}\{\text{Holdings}_{f,c} > 0\} \times \text{O\&G Share}_c / N_f$ – ignores loan size completely, exploiting connection to O&G-stressed CLOs

Table B.21: Robustness: Alternative O&G Exposure Weighting Schemes

	(1)	(2)	(3)	(4)	(5)
	Volume	Log	Equal	Count	Binary
	Weights	Weights	Weights	Weights	Exposure
<i>Panel A: Transaction Amount (\$ Million)</i>					
O&G Share $\times$ Post	-13.5289*** (2.3324)	-20.3401*** (3.1617)	-20.6267*** (3.2265)	-20.1221*** (3.3268)	-20.2100*** (3.1993)
Issuer-Type FE	✓	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓	✓
Currency FE	✓	✓	✓	✓	✓
N	136,808	136,808	136,808	136,808	136,808
R^2	0.0849	0.0852	0.0851	0.0851	0.0851
<i>Panel B: Secondary Loan Price (\$/\$100)</i>					
O&G Share $\times$ Post	-79.1517*** (28.4219)	-126.7102*** (41.7556)	-129.8827*** (42.8615)	-132.0492*** (45.0871)	-130.3186*** (42.5488)
Issuer-Type FE	✓	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓	✓
Currency FE	✓	✓	✓	✓	✓
N	136,827	136,827	136,827	136,827	136,827
R^2	0.4616	0.4617	0.4617	0.4617	0.4617

Notes: This table examines robustness to alternative constructions of firm O&G exposure. All specifications use the most saturated fixed effects structure from the main analysis: issuer-loan type, month-year, and currency fixed effects. Standard errors (in parentheses) are two-way clustered by CLO $\times$ issuer and trade date.

- **Volume Weights (Baseline):** Columns 1 and 6 use $\omega_{f,c} = \text{Holdings}_{f,c} / \sum_c \text{Holdings}_{f,c}$ – the dollar share of firm f 's total CLO debt held by CLO c
- **Log Weights:** Columns 2 and 7 use $\omega_{f,c} = \ln(\text{Holdings}_{f,c}) / \sum_c \ln(\text{Holdings}_{f,c})$
- **Equal Weights:** Columns 3 and 8 use $\omega_{f,c} = 1/N_f$ where N_f is the number of CLOs holding firm f 's debt – equal weight across all lenders regardless of position size.
- **Count Weights:** Columns 4 and 9 weight by the number of loans rather than dollar volume – $\omega_{f,c}$ is the share of firm f 's loans (not dollars) held by CLO c .
- **Binary Exposure:** Columns 5 and 10 use $\text{Exposure}_f = \sum_c \mathbb{1}\{\text{Holdings}_{f,c} > 0\} \times \text{O\&G Share}_c / N_f$ – ignores loan size completely, exploiting connection to O&G-stressed CLOs

Panel A uses transaction face amounts in millions of dollars; negative coefficients indicate increased selling. Panel B uses secondary loan transaction prices per \$100 of par.

Table B.22: Continuous Oil Price Specification

	(1)	(2)	(3)
	ID Test Ratio	Transaction Amt	Secondary Price
	(ln)	(\$ Million)	(\$/\$100)
<i>Panel A: Regression Coefficients</i>			
O&G Share $\times$ Oil Decline	-0.0046*** (0.0016)	-0.1768*** (0.0424)	-1.6226*** (0.3348)
<i>Panel B: Marginal Effects at Peak Oil Decline (\$68.61)</i>			
$\partial Y / \partial \text{O\&G Share}$	-0.3152*** (0.1122)	-12.1295*** (2.9082)	-111.3216*** (22.9666)
CLO FE	✓		
Issuer-Type FE		✓	✓
Month-Year FE	✓	✓	✓
Currency FE		✓	✓
Observations	1,867	136,808	136,808
R^2	0.8298	0.0845	0.4617

Notes: This table reports estimates from continuous oil price specifications:

$$Y_{i,t} = \beta_0 + \beta_1 \text{O\&G Share}_f + \beta_2 \text{OilDecline}_t + \beta_3 (\text{O\&G Share}_f \times \text{OilDecline}_t) + \gamma' Z_f + \alpha_i + \alpha_t + \epsilon_{i,t},$$

where i denotes the issue-type, f denotes the firm, and t indexes time. Z is a vector of firm controls including currency fixed effects. OilDecline_t measures the dollar decline in WTI crude oil price from the June 2014 baseline. $\text{O\&G Share}$ ranges from 0 to 1, representing the weighted average O&G portfolio share across all CLOs holding firm f 's debt, measured in May 2014 (pre-shock). Panel A reports the regression coefficients. Panel B reports the marginal effect of O&G Share evaluated at peak oil decline:

$$\frac{\partial Y}{\partial \text{O\&G Share}} = \beta_1 + \beta_3 \times \text{OilDecline}_{\text{peak}}.$$

At peak oil decline (December 2014: \$68.61), this evaluates to $\beta_1 + \beta_3 \times 68.61$. Because firm-level O&G exposures in the sample are small (IQR: 0.32%–2.84%), the 0–100% scaling in Panel B is a normalization rather than an in-sample scenario. To interpret economically meaningful magnitudes: at peak oil decline, a one percentage point increase in O&G exposure tightens covenant distance by 0.32% (Column 1), increases net selling by \$0.12 million (Column 2), and reduces secondary prices by \$1.11 per \$100 par (Column 3). Column 1 uses $\ln(\text{ID test ratio})$ as the dependent variable with CLO and month-year fixed effects. Columns 2–3 use issuer-type, month-year, and currency fixed effects. Standard errors in parentheses, clustered by deal and month-year (Column 1) and by $\text{CLO} \times \text{Issuer}$ and transaction date (Columns 2–3).

Table B.23: Distance to Interest Diversion Covenant and COVID-19 Exposure

	Distance to ID Threshold					
	(1)	(2)	(3)	(4)	(5)	(6)
COVID-19 Share $\times$ Post	-0.1698*** (0.0425)	-0.1716*** (0.0421)	-0.1723*** (0.0420)	-0.1743*** (0.0391)	-0.1837*** (0.0365)	-0.1833*** (0.0367)
COVID-19 Share	-0.2023** (0.0825)	-0.1115 (0.0794)	-0.0946 (0.0789)	-0.0168 (0.0522)		
Post	0.0038 (0.0049)	0.0040 (0.0048)			0.0056 (0.0040)	
CLO Controls		✓	✓	✓		
Manager FE	✓	✓	✓	✓		
Year FE		✓				
CLO-Year FE					✓	✓
Month-Year FE			✓	✓		✓
N	5,772	5,772	5,772	5,772	5,772	5,772
R ²	0.6611	0.6812	0.7096	0.7650	0.8322	0.8591

Notes: The table presents the relation between CLO COVID-19 exposure and distance to the Interest Diversion covenant. The regression specification is: $Y_{c,t} = \beta_0 + \beta_1(\text{CLO COVID-19 Exposure})_c + \beta_2(\text{Post})_t + \beta_3(\text{CLO COVID-19 Exposure}_c \times \text{Post}_t) + \gamma'_0 X_c + \alpha_c + \alpha_t + \epsilon_{c,t}$ where $Y_{c,t}$ is the distance to the Interest Diversion constraint ($\ln(\frac{\text{Current Performance}}{\text{Current Threshold}})$) of CLO c at time t , and X_c denotes the vector of controls, consisting of current CLO age in columns 2-4 and CLO size in columns 3-4, and CCC-share and defaulted-share (Column 4). COVID-19 Share _{c} is the share of CLO c in industries most vulnerable to COVID-19: O&G, automotive exposure, retail, durable consumer goods, cargo transportation, energy and transportation, and consumer sectors. Post _{t} is an indicator variable that takes a value of 1 after March 1, 2020 (onset of COVID-19 pandemic), and 0 otherwise. The analysis is restricted to 2020. The Standard errors are two-way clustered by CLO and month-year.

Table B.24: Secondary Loan Price and COVID-19 Exposure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Transaction Price (per \$100 par)	O&G	Auto	Retail	Consumer Goods	Cargo	O&G and Auto	Retail and Goods	All (Col 1-5)
COVID-19 Share $\times$ Post	-145.6504*** (27.8020)	-135.0664*** (34.4771)	-91.2316*** (15.0409)	-259.1544*** (45.9466)	-394.5945*** (69.7795)	-105.4744*** (18.8614)	-126.2100*** (16.3700)	-76.9684*** (11.2853)
Issuer-Loan Type FE	✓	✓	✓	✓	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Currency FE	✓	✓	✓	✓	✓	✓	✓	✓
<i>N</i>	356,481	354,651	354,005	363,840	359,489	347,161	353,852	332,550
<i>R</i> ²	0.6610	0.6631	0.6614	0.6680	0.6679	0.6558	0.6616	0.6454

Notes: The table examines whether COVID-19 sectoral shocks generate spillover effects on non-affected firms through CLO fire sales, analogous to the baseline O&G shock analysis. Each column measures a different dimension of firm exposure to COVID-19 vulnerable sectors through CLO holdings. The dependent variable is the secondary loan price (per \$100 of par). The regression specification is:

$$\text{Price}_{f,l,t} = \beta_1(\text{Sector Exposure}_f \times \text{Post}_t) + \beta_2 \text{Sector Exposure}_f + \beta_3 \text{Post}_t + \alpha_{f,l} + \alpha_t + \alpha_c + \epsilon_{f,l,t}$$

where f indexes firms, l indexes loan type, t indexes time, and c indexes currency. *Sector Exposure* measures the value-weighted share of CLO holdings allocated to the specified vulnerable sector(s), calculated as of pre-COVID. *Post* equals one after March 1, 2020 (onset of COVID-19 pandemic). The sample includes only firms outside the vulnerable sectors listed in each column header, capturing spillover effects on otherwise unaffected borrowers. O&G exposure in column 1, automotive exposure in column 2, retail exposure in column 3, durable consumer goods exposure in column 4, cargo transportation in column 5, energy and transportation sector (O&G + automotive) in column 6, consumer sectors (retail consumer goods) in column 7, and all COVID-vulnerable sectors combined in column 8. The analysis restricts to transactions before May 7, 2020 (Federal Reserve corporate credit facility announcement) to avoid contamination from policy interventions. Standard errors are two-way clustered by CLO $\times$ issuer and trade date.

Appendix C Data Construction of Firm-Level Variables

In this section, I describe the definition of variables.

1. *Debt Growth (long-term)* is defined as the natural log difference in long-term debt ($\Delta \ln(\text{dlttq})$).
2. *Sales Growth* is defined as the natural log difference in sales ($\Delta \ln(\text{saleq})$).
3. *Cash Flow* is the ratio of operating income before depreciation minus interest expense minus taxes to lagged total assets: $(\text{oibdpq} - \text{xintq} - \text{txtq}) / \text{atq}_{t-1}$.
4. *Investment-Capital Ratio* is defined as the ratio of the change in capital stock to the lagged capital stock. For each firm, the initial value of capital stock is equal to the level of gross plant, property and equipment (ppeg_t). This is k_{it+1} for firm i . The evolution of k_{it+1} is computed using changes in net plant, property and equipment (ppent). Missing observations of net plant, property, and equipment are estimated using linear interpolation of values right before and after the observation; values outside the observed range are not extrapolated. This definition is used in [Ottonello and Winberry \(2020\)](#).
5. *Acquisitions* is the ratio of acquisition expenditures to lagged total assets: $\text{aqcy} / \text{atq}_{t-1}$.
6. *R&D Growth* is defined as the natural log difference in R&D expenditures ($\Delta \ln(\text{xrdq})$).
7. *Employment Growth* is defined as the natural log difference in employment ($\Delta \ln(\text{emp})$).
8. *Capital Expenditures* is defined as the natural log of capital expenditures ($\ln(\text{capxy})$).
9. *Leverage* is defined as the ratio of total debt to total assets: $(\text{dltt} + \text{dlcq}) / \text{atq}$.