When Funding Markets Move Credit Markets: Foreign Investors and U.S. CLOs*

Amy W. Huber† Shohini Kundu‡

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Abstract

We show that U.S. leveraged credit markets and global dollar funding markets are jointly determined through the portfolio and funding decisions of Japanese banks, which hold roughly one-quarter of all U.S. CLO AAA tranches. The JPY–USD cross-currency basis, which measures the cost of obtaining dollars via FX swaps and forwards, is a strong predictor of AAA spreads and issuance, a relationship not found among other safe-assets. We develop a two-market equilibrium model in which the strength of pass-through from funding conditions to CLO spreads is governed by the aggregate demand elasticity of Japanese banks. We confirm the model's central prediction using three identification strategies: Japan's 2019 Basel III securitization rules, the Bank of Japan's 2023–2024 policy normalization, and quarter-end balance-sheet reporting cycles. Shocks that increase demand elasticity amplify basis pass-through, while shocks that decrease it dampen pass-through. These shocks are typically modeled as demand shifters. We show they also tilt the demand curve, altering the sensitivity of credit pricing to funding conditions. As a result, foreign market share alone understates domestic credit markets' vulnerability to external funding shocks, as spillovers depend not only on the level of participation but also on the elasticity of foreign investors' demand.

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†The Wharton School of the University of Pennsylvania. email: amyhuber@wharton.upenn.edu
‡UCLA Anderson School of Management and CEPR. email: shohini.kundu@anderson.ucla.edu

1 Introduction

Foreign investors hold trillions of dollars of U.S. fixed-income assets and play a central role in global capital markets (e.g., Du and Huber, 2024; Jiang, Krishnamurthy and Lustig, 2021). Because their balance sheets span both dollar funding markets and U.S. credit markets, shocks to funding conditions should, in principle, spill over into domestic credit pricing. Recent work indeed shows that foreign exchange (FX) hedging cost can induce foreign portfolio rebalancing and move U.S. corporate bond yields (e.g., Kubitza, Sigaux and Vandeweyer, 2024). But what governs the strength of this linkage? In particular, when do fluctuations in global dollar funding conditions materially affect U.S. credit market equilibrium, and how does that depend on the identity and constraints of the foreign investors who connect these markets?

Understanding the linkage between these two seemingly distant markets is empirically challenging. Because investor identities are often opaque, , so it is not obvious where exposure will surface. Even after identifying an exposed market, there is limited theoretical guidance on the mechanisms governing transmission, and testing any proposed mechanism requires plausibly exogenous variations. Credible evidence, therefore, requires a setting in which foreign investors are observable, concentrated, and exposed to identifiable shocks.

We study precisely such a setting in the market for U.S. collateralized loan obligations (CLOs). The CLO market finances approximately \$1 trillion of leveraged loans and represents the largest non-bank source of credit to U.S. corporations. The CLO market also offers an exceptional laboratory because foreign ownership is substantial and concentrated: at its peak in 2019, Japanese banks held approximately 35% of all U.S. CLO AAA tranches. These institutions fund their CLO positions by swapping yen into dollars using FX derivatives, tying their investment decisions to conditions in dollar funding markets while positioning them to influence equilibrium in both the U.S. CLO market and the JPY–USD funding market. We document a strong relationship between CLO issuance quantity and spreads and the JPY–USD cross-currency basis, the equilibrium price of dollar funding in FX markets. We then exploit three independent sources of variation—two quasi-natural experiments and recurring quarter-end reporting cycles—to show that, consistent with our model, the sensitivity of CLO spreads to FX funding shocks is endogenous to the constraints facing Japanese investors, increasing when their demand becomes more elastic and decreasing when it becomes more inelastic.

We begin by assembling a unique dataset that links U.S. CLO issuance to holdings by Japanese investors. Using PitchBook data on CLO issuance and proprietary supervisory data from the Bank of Japan, we provide the first direct documentation of Japanese banks' footprint in the CLO market. Their presence is both large and rising. At its peak in 2019, Japanese banks held almost one-quarter of all outstanding U.S. CLOs, and their exposure was concentrated almost entirely in the AAA tranche.

Combining issuance data with prices from FX derivative markets, we document a strong comovement between U.S. CLO activity and FX funding conditions. Over the 2012–2025 period, aggregate CLO issuance volume exhibits a correlation of 0.82 with the JPY–USD cross-currency basis. The basis measures the cost of obtaining U.S. dollars by pledging yen via FX derivatives, the channel through which Japanese banks fund their CLO positions.[1] Importantly, the JPY–USD basis is also a statistically significant predictor of CLO AAA issuance spreads (measured relative to LIBOR/SOFR), even after controlling for a broad set of macroeconomic variables. This relationship is unique to the JPY-USD basis and is not observed for other major cross-currency bases. Nor is it observed for comparable assets such as US Treasury fixed- and floating-rate securities and high-yield bonds, suggesting that the basis–spread linkage is not driven by common factors affecting safe assets, floating-rate instruments, or underlying corporate borrowing conditions.

To understand the economic forces underlying this linkage, we develop a two-market equilibrium model in which CLO spreads and the cross-currency basis are jointly determined by Japanese banks' portfolio and funding decisions, CLO managers' structuring choices, and global dealer intermediation capacity. In the spirit of "market macrostructure" models (Haddad and Muir, 2025), we characterize equilibrium prices as emerging from the institutional constraints and portfolio rules of key market participants. Our framework extends An and Huber (2026) by allowing prices and quantities in both the CLO market and the FX funding market to be jointly determined. In this setting, improvements in FX funding conditions lower CLO spreads (raise prices) and increase CLO issuance. More importantly, the sensitivity of both CLO spreads and issuance to funding conditions is governed by the aggregate demand elasticity of Japanese banks, which in turn depends on regulatory capital requirements and the composition of active institutions. The model therefore predicts that changes in aggregate demand elasticity amplify or attenuate the transmission of FX funding shocks into the CLO market.

We exploit two quasi-natural experiments to test the model's mechanism. The first is the Japanese Financial Services Agency's 2019 implementation of Basel III risk-retention

[1] The investor presentation of Norinchukin Bank, the largest Japanese holder of CLOs, notes that its foreign currency investments are "maintained by secured funding mainly, whose collateral is ample JPY deposits from members for currency/FX swaps and high-quality liquid assets for repo transactions." See the 2024 bank company presentation for details.

rules, which disproportionately increased the regulatory capital cost of CLO investments for Japanese banks. The second is the Bank of Japan's October 2023 adjustment to yield curve control, which raised domestic yen yields and increased the attractiveness of domestic assets. Both shocks originated in Japan and did not directly alter FX derivatives market structure, CLO supply technology, or broader U.S. credit conditions, providing a clean empirical setting. Moreover, the two shocks operate through distinct channels that offer complementary tests of the model mechanism. Basel III raised regulatory costs unevenly across institutions, shifting weight within the Japanese investor base away from the concentrated, price-insensitive anchor toward more elastic buyers and thereby raising aggregate demand elasticity. In contrast, the BOJ normalization improved the domestic outside option, raising the shadow cost of CLO investment for all banks and reducing aggregate demand elasticity. The model therefore predicts amplified pass-through following the first shock and dampened pass-through following the second.

Our main empirical finding is that the sensitivity of U.S. CLO AAA spreads and issuance to the cross-currency basis is not a fixed structural constant but shifts sharply with regulatory and monetary policy in the creditor country. Before 2019, the sensitivity of AAA spreads to the basis is modest: a 10-basis-point improvement in the basis (cheaper dollar funding) compresses AAA spreads by roughly 5 basis points. After the Basel III reform, this sensitivity roughly triples. Following the 2023–2024 BOJ normalization, pass-through attenuates to roughly 15 basis points per 10-basis-point improvement, still steeper than the pre-2019 regime but materially below the 2019–2023 peak. Issuance exhibits the same pattern: its sensitivity to funding conditions strengthens after the 2019 Basel reform and weakens following the BOJ normalization. Together, these price and quantity responses support the model's central prediction that regulatory and policy shocks can change the slope, and not merely the level, of aggregate demand.

Lastly, we examine quarter-ends as a high-frequency shock to Japanese banks' CLO demand. Because regulatory surcharges are assessed using balance-sheet snapshots at quarter-end, the shadow cost of marginal positions rises on these dates (Du, Tepper and Verdelhan, 2018). In the model, this increase in marginal regulatory cost reduces aggregate demand elasticity and dampens funding pass-through. Consistent with this mechanism, we find that pass-through from FX funding to both CLO spreads and issuance volume is attenuated at quarter-end.

The paper makes three contributions. First, we provide direct evidence that investor demand elasticity governs not only the equilibrium of a single market but also the transmission of shocks across markets in which those investors are marginal. This extends the growing literature on demand-based asset pricing in individual markets, by showing that the elasticity of key participants shapes joint equilibrium across interconnected markets. Our findings highlight how constrained intermediaries propagate shocks in globally integrated financial systems (An and Huber, 2025), with implications for macroprudential regulation.

Second, we show that demand elasticity is itself endogenous to regulation and outside options. These shocks are often modeled as parallel shifts in demand, but we demonstrate that they can also tilt the demand curve by altering aggregate elasticity. The 2019 regime shift in the CLO spread–basis relationship illustrates this mechanism. After Basel III, U.S. CLO pricing became more sensitive to foreign funding conditions, even as Japanese ownership of AAA tranches declined from approximately 35% to 20%. We trace this amplification directly to a compositional shift within the Japanese investor base: the single most concentrated and price-insensitive holder lost weight to more elastic buyers, raising aggregate demand elasticity while total foreign ownership fell. After the BOJ normalization, pass-through weakened despite the Japanese investor base remaining substantial. Our results imply that a market's exposure to foreign capital cannot be inferred from foreign market share alone: what matters is the elasticity of foreign demand, which can be reshaped by regulation and monetary policy in the creditor country.

Third, we highlight the importance of foreign investors for U.S. domestic credit conditions. The leveraged loans underlying CLOs are overwhelmingly domestic, yet their financing costs are materially influenced by external funding conditions. Because AAA CLO tranches resemble other safe and liquid assets widely held by foreign institutions, the mechanism we document likely extends beyond the CLO market to other segments of U.S. credit with substantial foreign ownership.

1.1 Related Literature

Our paper contributes to four strands of the literature: the macroeconomics of foreign safe asset demand, the microstructure of CIP deviations and intermediary constraints, the growing empirical literature on CLO markets, and the emerging "market macrostructure" approach to institutional asset pricing. We discuss each in turn.

First, we extend the literature on foreign safe-asset demand by showing that equilibrium in asset markets is jointly determined with equilibrium in funding markets when marginal investors operate in both. Existing work documents the effects of demand on either asset prices (e.g., Jansen, Li and Schmid, 2024; Bretscher et al., 2026) or exchange rates and funding conditions (e.g., Jiang, Krishnamurthy and Lustig, 2021; Du and Huber, 2024). In contrast, we study how these equilibria are jointly determined by the portfolio and funding decisions of common marginal investors. The CLO AAA market provides a unique setting in which foreign investor identity is observable and policy shocks are identifiable, allowing us to deliver causal evidence. Because AAA CLO tranches are highly rated, historically loss-free, and function as safe dollar assets, our findings on cross-market shock propagation (An and Huber, 2025) are applicable beyond structured credit to other U.S. safe assets with substantial foreign ownership.

Second, we provide direct evidence on how CIP deviations transmit to credit markets and what governs the strength of that transmission. Beginning with Du, Tepper and Verdelhan (2018), a large literature interprets CIP deviations as reflecting the cost of FX intermediation and dollar funding (e.g., Cenedese, Della Corte and Wang, 2021; Du, Hébert and Huber, 2023). Recent work such as Kubitza, Sigaux and Vandeweyer (2024) documents that CIP deviations are linked to U.S. corporate bond yields. We build on these insights and examine the determinants of the magnitude of this linkage using a two-market equilibrium framework. Our modeling approach draws on An and Huber (2026), which emphasizes the joint determination of price and quantity in funding markets. We extend it by showing that commonly studied shocks such as regulatory tightening and changes in outside options can tilt, rather than merely shift, the demand curve.

Third, we identify a new source of fragility in CLO markets. Existing work studies CLOs from within, focusing on securitization and credit supply (Nadauld and Weisbach, 2012; Shivdasani and Wang, 2011), adverse selection in loan pools (Benmelech, Dlugosz and Ivashina, 2012), covenant externalities and fire sales (Kundu, 2024, 2025), and tranche-level risk-adjusted performance (Cordell, Roberts and Schwert, 2023). These studies emphasize internal deal mechanics, i.e., manager selection, covenant structure, and the waterfall allocation of cash flows. In contrast, we ask who the marginal buyers of senior tranches are and how changes in their demand elasticity affect pricing. Because Japanese banks are dominant holders of AAA tranches (DeMarco, Liu and Schmidt-Eisenlohr, 2020) and fund their positions through FX markets, AAA pricing is linked to dollar funding conditions through a channel that is invisible from within the CLO structure itself.

Fourth, our paper applies the "market macrostructure" framework of Haddad and Muir (2025), which studies how institutional structure and key intermediaries shape asset prices. The CLO market provides an ideal setting: key players are identifiable, positions are observable through regulatory disclosures, institutional shocks provide quasi-natural experiments, and the need for FX-derivative enabled synthetic funding creates a second market that disciplines equilibrium pricing. By combining institutional position data, exogenous shocks, and a two-market equilibrium model, we connect the organization of market participants to joint price determination across funding and credit markets.

The remainder of the paper is organized as follows. Section 2 describes the institutional background on the CLO market, Japanese bank investment, and the cross-currency basis as a sufficient statistic for hedging costs. Section 3 describes the data. Section 4 documents the aggregate relationship between the basis and CLO pricing. Section 5 develops the two-market equilibrium model. Section 6 tests the model's predictions using two quasi-natural experiments and quarter-end effects. Section 7 concludes.

2 Institutional Background

This section outlines the institutional environment underpinning our empirical analysis. We begin by characterizing the structure and funding model of the U.S. CLO market, with particular emphasis on tranche design, investor clientele, and the determinants of AAA spreads. We then examine the emergence of Japanese banks as the marginal foreign investors in AAA CLO tranches, highlighting the regulatory, balance sheet, and yield considerations that shape their demand. A case study of Norinchukin Bank, the single largest institutional holder of CLO AAA tranches globally, illustrates the scale at which a single institution connects the CLO and FX funding markets. Because these institutions typically fund their dollar asset positions by pledging yen through FX swaps and forwards, their required returns are directly linked to conditions in FX derivatives markets. As a result, variation in the cross-currency basis becomes a key state variable influencing equilibrium CLO pricing.

2.1 The US CLO Market

A collateralized loan obligation (CLO) is a securitization vehicle that pools diversified portfolios of senior secured leveraged loans and issues tranched liabilities against the pool's cash flows.[2] A typical CLO capital structure consists of six to eight tranches ranging from AAA (approximately 60-65% of the deal by par value) down through AA, A, BBB, and BB to an unrated equity tranche.[3] AAA tranches absorb losses only after all subordinate tranches are exhausted. AAA have experienced zero principal losses histori-

[2]See Kundu (2023) for a comprehensive overview of CLO market structure, the mechanics of the CLO waterfall, and the role of covenants in governing CLO manager behavior.

[3]Panel (b) of Appendix Figure B.1 plots the AAA share of total CLO issuance over time.

cally, even through the 2008–2009 financial crisis.[4] AAA tranches are floating-rate instruments, typically paying three-month SOFR (previously LIBOR) plus a spread, known as the discount margin.

CLOs are managed vehicles: a collateral manager actively trades the underlying loan portfolio during a reinvestment period (typically four to five years), after which the deal enters an amortization phase. Total US CLO outstanding grew from approximately $400 billion in 2015 to over $1 trillion in 2024, driven by strong leveraged loan origination and robust investor demand for floating-rate credit exposure.[5]

The investor base for CLO tranches is segmented by seniority. AAA tranches are held primarily by banks, both domestic US institutions and foreign banks (particularly Japanese), along with a growing share of CLO exchange-traded funds. Mezzanine tranches (AA through BBB) are purchased mainly by insurance companies and asset managers. Equity tranches are retained by CLO managers and held by hedge funds and dedicated CLO equity vehicles (DeMarco, Liu and Schmidt-Eisenlohr, 2020).

The investor base for AAA tranches segments into two functionally distinct groups whose demand differs both in sensitivity and in the transmission mechanism. Domestic US investors such as commercial banks and CLO ETFs, fund their positions in dollars from dollar liabilities and price CLOs against adjacent dollar-denominated alternatives such as agency MBS and US Treasuries. Their demand for CLOs is heavily influenced by restrictions on bond-bucket holdings (e.g., the Volcker Rule) and buy-and-hold mandates (especially among CLO ETF vehicles). As a result, US domestic demand is relatively inelastic at the margin. Foreign demand operates differently. Japanese banks fund their CLO positions through FX swaps, so their reservation spread is governed by the cost of synthetic dollar funding rather than by domestic dollar alternatives. This makes their demand responsive to the cross-currency basis in a way that no domestic US investor's demand can be, and positions Japanese banks as the marginal price-setters at the AAA tranche.

2.2 Japanese Banks as CLO Investors

Japanese banks have been the single largest foreign investor class in US CLO AAA tranches since the mid-2010s.

[4] According to Lane, Novell and Rawlings (2024), nearly 7,000 AAA-rated CLO debt tranches were issued between 1993 and 2022 had zero defaults. The lowest rated debt tranche reported a 1.8% default rate. See Hu et al. (2006) for Default & Loss Rates of Structured Finance Securities overall from 1993-2005.

[5] We estimate the size of the CLO market based on a perpetual inventory method applied to annual issuance data from our sample, assuming a 13% annual runoff rate consistent with a 7–8 year average CLO life. See Section 3 for details.

According to data from the Bank of Japan Financial System Report, Japanese banks' aggregate CLO holdings grew from ¥5.1 trillion ($42 billion) in fiscal year 2015 to ¥19.7 trillion ($131 billion) in fiscal year 2024, a nearly fourfold increase (Financial System and Bank Examination Department, Bank of Japan, 2025). Figure 1 documents this growth. Panel (a) shows the composition of Japanese banks' overseas credit holdings, with CLOs growing from a small fraction to the second-largest category by 2024. Panel (b) indexes each asset class to 100 in 2015, revealing that CLO holdings grew approximately 300% over the decade, far outpacing investment-grade corporates, high-yield bonds, or other structured products. Over this period, CLOs increased from 8.5% to 22.6% of Japanese banks' overseas credit holdings, as shown in Appendix Figure B.2. Year-on-year CLO growth peaked at nearly 80% in 2018 before decelerating sharply following the 2019 regulatory shock, as shown in Appendix Figure B.3.

At their peak in 2019, we estimate that Japanese banks held over 20% of all outstanding US CLOs and accounted for approximately 35% of new US CLO AAA issuance.[6] Figure 2 presents these estimates. Panel (a) plots Japanese banks' CLO holdings in USD billions (left axis) against their share of US CLOs outstanding (right axis), where outstanding is constructed using a perpetual inventory method. Panel (b) plots the Japanese share of total US CLO outstanding alongside their share of US CLO AAA issuance.[7] No other investor bloc combined this scale with demand that responds to FX funding costs. Domestic US institutions hold AAA paper in size but price it inelastically against dollar alternatives; Japanese banks, whose reservation spread moves with the cross-currency basis, are therefore the marginal price-setters for senior CLO securities and central to the determination of equilibrium AAA spreads.

The concentration of Japanese CLO investment is extreme: Norinchukin Bank, the central cooperative bank for Japan's agricultural and fishery cooperative system, alone accounted for approximately half of all Japanese CLO holdings at its peak, earning it the nickname "the CLO whale" in market commentary. Appendix A provides a detailed case study of Norinchukin's investment strategy, illustrating how a single institution's portfolio decisions connect the CLO and FX funding markets at scale.

[6]Japanese banks' holdings are concentrated almost exclusively at the top of the capital structure. A joint survey by the Bank of Japan and the Financial Services Agency found that more than 99% of major Japanese banks' CLO holdings were rated AAA (Financial System and Bank Examination Department of the Bank of Japan, 2020).

[7]The AAA issuance share is estimated by assuming that AAA tranches constitute approximately 65% of each deal's capital structure, consistent with industry averages shown in Appendix Figure B.1.

2.2.1 The Funding Decision

Japanese banks fund their US CLO holdings primarily with yen-denominated liabilities such as retail and cooperative deposits. To finance their dollar asset holdings, they convert yen funding into dollars using FX swaps or cross-currency basis swaps. In a standard USD/JPY basis swap, a Japanese bank exchanges yen for dollars at the outset of the contract. Thereafter, it receives yen interest payments and pays dollar interest payments over the life of the swap, and reverses the principal exchange at maturity. This structure allows the bank to fund its CLO purchase in yen while converting all dollar cash flows (both coupons and principal) back into yen.

The cost of FX funding is summarized by the USD/JPY cross-currency basis, defined as the deviation from covered interest parity embedded in FX swap markets. Formally,

$$x_t = \underbrace{r_{\$,t,\tau}}_{\text{return from directly funding \$}} - \left(\underbrace{r_{¥,t,\tau} + \frac{12}{\tau}(s_{¥,t,\tau} - f_{¥,t})}_{\text{return from synth funding \$}} \right)$$

For much of the post-GFC period, the USD/JPY basis has been negative, implying that yen-based investors must pay an additional premium to obtain synthetic dollar funding. A more negative basis, therefore, increases the effective cost of holding hedged dollar assets.

The all-in funding-adjusted return on a CLO AAA position for a Japanese bank can be written as:

$$\text{Funding-Adjusted Return} = \underbrace{s}_{\text{CLO spread}} + \underbrace{\kappa_i x_t}_{\text{funding cost}} - \underbrace{\tau}_{\text{regulatory cost}},$$

where s is the CLO AAA discount margin, κ is the share of investment funded using FX derivatives, x is the cross-currency basis, and τ is the regulatory capital cost of holding securitization exposures. The bank invests in CLOs only when this funding-adjusted return is positive. This decision rule, formalized in Section 5, establishes the direct link between CLO AAA spreads and the cross-currency basis that is the focus of our empirical analysis.

Figure 3 illustrates why this condition is relevant for CLO AAA tranches but not for the safe dollar assets Japanese banks also hold. The figure plots funding-adjusted, yen-equivalent yields on two dollar assets: five-year U.S. Treasuries and CLO AAA tranches.[8]

[8]Funding-adjusted, yen-equivalent yields are computed as the U.S. dollar yield minus the absolute value of the JPY-

During most of our sample period, funding-adjusted Treasury yields hover near or below zero: after paying for synthetic dollar funding, a Japanese bank earns little or nothing on what is nominally a risk-free dollar asset. Funding-adjusted CLO AAA yields, by contrast, remain positive throughout, typically 1–3 percentage points above Treasuries, reflecting the spread premium that compensates for illiquidity and complexity. This wedge explains why Japanese banks fund their CLO positions through FX derivatives, linking demand for U.S. CLOs to FX funding conditions.

Two features of this funding arrangement merit emphasis. First, Japanese banks fund a large fraction of their CLO exposure synthetically through FX markets; they do not carry material unhedged dollar risk. CLO demand and FX funding demand therefore move nearly one-for-one: an increase in CLO purchases generates a corresponding increase in demand for FX swaps, pushing the basis more negative and raising funding costs for all yen-based dollar investors. FX funding is rolled at regular intervals (typically quarterly), so the basis enters as a flow cost rather than a one-time expense; we use the five-year basis as a duration-matched summary of this rolling cost over the life of a CLO position, and show in Section 4.5 that results hold across tenors.

These features imply that the cross-currency basis serves as a sufficient statistic for the funding cost faced by the marginal price-setter in the CLO AAA market. Any shock that affects Japanese demand for CLOs, whether regulatory, monetary, or otherwise, operates through the basis: directly, by changing the cost of synthetic dollar funding, or indirectly, by changing aggregate funding demand, which in turn moves the basis in equilibrium.

3 Data

Our analysis combines seven categories of data: (1) CLO market data from PitchBook LCD, (2) cross-currency basis swap rates from LSEG Datastream and Bloomberg, (3) the US–Japan government-bond rate differential from FRED and the Japanese Ministry of Finance, (4) macroeconomic and financial controls from FRED and Datastream, (5) Japanese banks' overseas credit holdings from the Bank of Japan, (6) institution-level CLO holdings from Norinchukin Bank's financial disclosures, and (7) Japanese bank capital ratios from SEC Form 20-F filings and Norinchukin's capital adequacy disclosures. The baseline sample spans 2012Q1 through 2025Q4. This section describes each data source, the key variables we construct, and the resulting samples for the aggregate and tranche-level analyses.

USD cross-currency basis at the matching tenor. For Treasuries, we use the five-year constant maturity yield; for CLO AAA tranches, we use the quarterly average AAA spread (discount margin) plus the prevailing SOFR (or LIBOR) rate.

3.1 CLO Market Data

Tranche-level CLO data come from PitchBook LCD's Global CLO Databank. For each CLO tranche priced between January 2012 and March 2025, we observe the deal identifier, tranche rating (AAA through B), discount margin over the benchmark floating rate, coupon in basis points, tranche size, total deal size, CLO manager, benchmark rate (LIBOR or SOFR), and pricing date. We restrict the sample to US dollar-denominated tranches in new-issue CLOs, excluding refinancings and resets, with ratings from AAA to B.

The primary dependent variable is the tranche spread, defined as the discount margin at issuance. When the discount margin is missing (as occurs for some fixed-rate tranches), we substitute with the coupon in basis points. We construct the tranche share as tranche size divided by total deal size, and use the log of tranche size and log of deal size as additional outcome variables.

PitchBook LCD also provides aggregate quarterly CLO issuance volume (in billions of US dollars), quarterly deal counts, and a quarterly index of US CLO AAA discount margins. These series form the basis for the aggregate regressions. For the cross-market placebo tests, we obtain high-yield bond issuance volume and yield spreads from PitchBook LCD's US High-Yield Bond Volume Report, and auction-level data for Treasury floating-rate notes and two-year fixed-rate notes from the U.S. Department of the Treasury via the TreasuryDirect API. The Treasury FRN discount margin, expressed in basis points over the 13-week Treasury bill rate, is directly analogous to the discount margin on CLO AAA tranches, making it a natural comparator for the specificity tests in Section 4.2.

3.2 Cross-Currency Basis

The key explanatory variable is the five-year JPY-USD cross-currency basis swap rate, obtained as daily bid, ask, and mid-price quotes from Thomson Reuters Datastream. The basis measures the cost of converting yen funding into synthetic US dollars via the FX swap market; a more negative basis indicates higher hedging costs for Japanese investors. We use the mid-price throughout. For the aggregate regressions, we collapse the daily series to quarterly frequency by averaging within each calendar quarter. For the tranche-level regressions, we collapse to monthly frequency and merge to each tranche's pricing month.

We choose the five-year cross-currency basis swap to match the typical investment horizon for CLOs. For robustness, we also construct the basis at shorter tenors as the deviation from covered interest parity, combining the JPY-USD spot exchange rate, the outright forward, and domestic and foreign overnight-indexed-swap (OIS) rates, all from Bloomberg at daily frequency. We measure these short-tenor series over OIS to remove any bank credit risk and to ensure continuity even after LIBOR discontinuation.

3.3 US-Japan Rate Differential

To distinguish the FX-funding-cost channel from a yield-chasing motive, we construct the differential between US and Japanese government bond yields at matched tenor. The US–Japan 5-year rate differential is the monthly average of the US 5-year Treasury constant maturity yield minus the Japanese 5-year government bond yield from the Ministry of Finance daily interest-rate publication, aggregated to monthly frequency. We collapse the differential to quarterly frequency for the aggregate specifications and match it to each tranche's pricing month for the tranche-level specifications.

3.4 Macroeconomic and Financial Controls

We further collect data on US financial conditions and macroeconomic fundamentals. From the Federal Reserve Bank of St. Louis (FRED), we obtain the CBOE Volatility Index (VIX), the ten-year minus three-month Treasury term spread, the Moody's BAA minus AAA corporate credit spread, industrial production, the unemployment rate, and the Chicago Fed National Financial Conditions Index (NFCI, weekly frequency). We construct the commercial paper spread as the difference between the three-month AA financial commercial paper rate and the three-month Treasury bill rate, which captures short-term funding stress in money markets.[9] The JPY-USD spot exchange rate controls for the level of the yen.

From LSEG Datastream, we obtain the ICE BofA MOVE Index, which measures implied volatility on US Treasury options and serves as a proxy for interest rate uncertainty. We also obtain the KBW Nasdaq Bank Index, from which we compute an annualized realized volatility measure.[10] This bank sector volatility measure captures stress in the financial intermediary sector that could independently affect both CLO pricing and the cross-currency basis.

All daily and weekly control variables are collapsed to quarterly frequency by averaging within each calendar quarter before merging with the aggregate CLO data.

[9]This is sometimes referred to as the CP-Treasury spread. We use the FRED series `RIFSPPFAAD90NB` (3-month AA financial CP) and `DGS3MO` (3-month Treasury constant maturity).

[10]Daily returns are calculated from closing prices, and a rolling 30-trading-day standard deviation is annualized by multiplying by $\sqrt{252}$.

3.5 Japanese Banks' Overseas Credit Holdings

Data on Japanese banks' foreign credit portfolios come from the Bank of Japan's *Financial System Report* (October 2025 edition, Chart III-1-17). The BOJ reports major banks' overseas credit product holdings decomposed into four categories: investment-grade corporate bonds, high-yield corporate bonds, CLOs, and other structured products in JPY trillions at fiscal year-end (March of each year). The data span fiscal years 2015 through 2024.

To compute Japanese banks' share of the US CLO AAA market, we convert the BOJ's yen-denominated holdings to US dollars using annual average JPY-USD exchange rates from FRED. We then construct a time series of total US CLO AAA outstanding using a perpetual inventory method: starting from 2001, we accumulate annual CLO issuance (from PitchBook) and apply a 13% annual runoff rate, reflecting the approximately 7.5-year average CLO life (five-year reinvestment period plus two to three years of amortization). We estimate AAA outstanding as 65% of total CLO outstanding, consistent with the average AAA tranche share in our sample.

3.6 Norinchukin CLO Holdings

To document the concentration of Japanese CLO investment, we compile a quarterly time series of Norinchukin Bank's CLO holdings from the institution's official financial results disclosures. The data, reported in JPY trillions, are hand-collected from Norinchukin's semi-annual and quarterly capital adequacy reports covering fiscal years 2012 through 2025. Norinchukin is the central bank for Japan's agricultural cooperative system and was, at its peak, the single largest institutional holder of US CLO tranches globally, accounting for approximately half of all Japanese CLO holdings.

Norinchukin's holdings provide the highest-frequency available time series for any individual Japanese investor in U.S. CLOs and are central to the elasticity decomposition in Section 6.1.4.

3.7 Japanese Bank Capital Ratios

CET1 capital ratios for the three Japanese megabanks active in the U.S. CLO market: Mitsubishi UFJ Financial Group (MUFG), Sumitomo Mitsui Financial Group (SMFG), and Mizuho Financial Group (Mizuho), are extracted from each bank's SEC Form 20-F filings (Regulatory Capital Requirements sections and supporting narrative). For Norinchukin, CET1 ratios come from the same capital adequacy disclosures used to construct the bank's

CLO holdings. The four-bank panel spans fiscal years 2021 through 2025. We use these ratios to test capital scarcity as a competing mechanism for the change in pass-through documented in Section 6.2.2.

4 The Cross-Currency Basis and CLO Pricing

The institutional background in Section 2 suggests that the JPY-USD cross-currency basis is a first-order determinant of CLO AAA pricing: it governs the funding cost faced by the dominant marginal investors.

This section documents three empirical patterns that motivate the model and identification strategy that follow. First, the basis is strongly correlated with aggregate CLO issuance volume and spreads, even after controlling for a rich set of macroeconomic variables. Second, this relationship is highly specific: it holds in the CLO market but not in comparable fixed-income markets where Japanese banks are not the marginal investor, it is unique to the JPY-USD basis among major cross-currency bases, and it survives controlling for the US–Japan interest-rate differential. Third, the relationship changes sharply after 2019, a shift that the model in Section 5 rationalizes and the identification strategy in Section 6 tests formally.

4.1 Aggregate Evidence

Figure 4a plots quarterly US CLO new-issue volume alongside the five-year JPY-USD cross-currency basis from 2012 through 2025. The two series co-move closely: quarters in which funding costs are low (the basis is less negative) coincide with elevated issuance, and vice versa. The raw correlation is 0.82, reflecting striking comovement across two distinct markets.[11] Figure 4b plots the corresponding relationship for CLO AAA spreads. The unconditional correlation is comparatively modest, at -0.25, in part because it masks a striking regime shift, which we document in Section 4.6. Indeed, the relationship is substantially stronger within each subperiod than in the pooled sample.

Table 1 formalizes the visual evidence through a regression framework. We find that a 10-basis-point improvement in the basis is associated with approximately 19% higher

[11] The comovement between the basis and CLO issuance extends to the AAA tranche. Appendix Figure B.1 shows that AAA tranche volume tracks total issuance closely in Panel (a). Panel (c) shows that the AAA tranche volume exhibits a 0.81 correlation with the basis, nearly identical to the total issuance figure. The AAA share of issuance itself is positively correlated with the basis in Panel (d) with a correlation coefficient of 0.30, suggesting that deal structures tilt toward larger senior tranches when Japanese demand is strong.

quarterly issuance volume (column 1), 19% more deals priced (column 2), and a 3.4-basis-point compression of AAA spreads (column 3). The basis alone explains 62% of the variation in log issuance and 67% of the variation in log deal counts.

The joint response of prices and quantities is informative about the underlying mechanism. A purely supply-side explanation — for example, CLO managers timing issuance to favorable funding conditions, would predict higher issuance volumes but ambiguous effects on spreads. In contrast, the finding that a more favorable basis is associated with both higher issuance *and* lower spreads points to a demand-side channel. That is, when funding costs fall, Japanese investors are willing to absorb more AAA paper at tighter spreads, inducing the CLO issuance pipeline to supply additional deals to market.

4.2 Specificity to the CLO Market

The co-movement documented above could reflect common exposure to global financial conditions rather than a direct link from funding costs to CLO pricing. We address this concern in two steps: first, by showing that the basis predicts CLO AAA spreads even after absorbing a rich set of macrofinancial controls, and second, by showing that this relationship is absent in other fixed-income markets where Japanese banks are not the marginal investor.

Table 2 regresses quarterly CLO AAA spreads on the JPY-USD basis while progressively adding controls for market volatility (VIX, MOVE), the yen-dollar exchange rate, short-term funding stress (the commercial paper–Treasury spread), credit conditions (the Moody's BAA-AAA spread and the term spread), bank sector health (KBW index realized volatility), and macroeconomic indicators (industrial production, unemployment, NFCI). The coefficient on the basis remains statistically significant across all specifications, ranging from -0.34 to -0.90 across specifications, with -0.55 in the most saturated column. These estimates imply that a 10-basis-point improvement in the basis is associated with a 3.4 to 9.0-basis-point compression in CLO AAA spreads, even after absorbing variation attributable to broad financial conditions, credit market stress, and the macroeconomy. Notably, the magnitude of the coefficient increases rather than attenuates as controls are added, suggesting that omitted-variable bias, if anything, biases the univariate specification toward understating the true effect. Appendix Table C.1 reports the analogous exercise for log issuance volume; the basis coefficient similarly remains positive and significant through the addition of volatility and exchange rate controls

Table 3 next examines whether the basis-spread relationship is unique to the CLO market. Column (1) reproduces the most saturated CLO AAA specification from Table 2.

Columns (2)–(4) estimate the identical regression—same controls, same sample period—on three placebo markets that are, in principle, comparable to CLO AAA but in which Japanese banks are unlikely to be the marginal price-setter. These are the markets for the 2-year Treasury note, Treasury floating-rate note, and high-yield bond.

The Treasury markets provide a natural benchmark, as these are safe assets with substantial foreign participation. Yet, as shown in column (2), the JPY-USD basis is not a significant predictor of the 2-year Treasury yield. Despite holding over $1 trillion of Treasuries, Japanese investors account for only about 4% of Treasury outstanding, compared to 20–35% of CLO AAA tranches, documented in Figure 2b, and are therefore unlikely to be marginal in pricing.

Because CLO AAA tranches are floating-rate instruments, we next examine Treasury FRNs, which share the discount-margin pricing structure but in which Japanese banks are not marginal. As in column (2), the basis coefficient in column (3) is economically small and statistically insignificant, ruling out the possibility that the basis primarily affects floating-rate assets.

Column (4) turns to high-yield bonds. CLOs and high-yield bonds share the same underlying borrower base, as CLO collateral pools consist primarily of leveraged loans issued by the same below-investment-grade firms that access the high-yield bond market. If the basis were proxying for credit conditions affecting these borrowers, one would expect similar basis sensitivity across the two markets. Instead, the basis coefficient for high-yield spreads is statistically indistinguishable from zero.

Across all three placebo markets, the cross-currency basis has no predictive power for yields or spreads once macro-financial conditions are controlled for. This stands in sharp contrast to the CLO market, where Japanese banks are the marginal investor. Taken together, these results rule out explanations based on global risk appetite, broad dollar funding stress, or credit conditions common to leveraged borrowers, and instead support a demand-side channel operating precisely where Japanese banks link FX funding markets to US credit.

4.3 Currency Specificity

If the JPY-USD basis predicts CLO AAA spreads through a Japanese marginal-investor channel, its predictive power should be unique to JPY among major cross-currency bases, rather than a general dollar-funding factor affecting all G10 currencies symmetrically. We test this on the AAA tranche-level panel.

Column (1) of Table 4 reports a horse race in which the spread of AAA CLO tranches is regressed on the 5-year JPY-USD, EUR-USD, and GBP-USD bases simultaneously, with manager, arranger, benchmark rate, and year fixed effects, so that identification comes from within-year variation across the three cross-currency bases rather than from common annual trends. In the horse race, the JPY-USD basis is the most significant of the three and is largest in magnitude, entering at the 1% level with the expected negative sign: a 10-basis-point improvement compresses AAA spreads by approximately 13.8 basis points. The GBP-USD basis is only weakly significant, at the 10% level, and with a smaller coefficient, while the EUR-USD basis is statistically insignificant and enters with a positive sign. The three bases are, however, highly correlated in our sample (pairwise correlations 0.79–0.93), raising the concern that multicollinearity, rather than a genuine JPY-specific effect, is what separates the coefficients and could also explain why EUR-USD and GBP-USD fail to enter reliably.

We therefore rely on the principal-component decomposition in column (2), which is designed for exactly this collinearity. Because PC1 is constructed to absorb the common variation across all three bases, this specification omits year fixed effects, which would otherwise compete with PC1 to absorb the same shared dollar-funding variation; the specification retains manager, arranger, and benchmark rate fixed effects. We extract the first principal component (PC1) of the three cross-currency bases, which captures 89.5% of their joint variation, and construct the JPY-specific residual as the JPY basis orthogonalized against PC1.[12] Both PC1 and the JPY-specific residual are statistically significant predictors of AAA spreads. The PC1 coefficient reflects exposure to common dollar-funding stress, and the JPY-residual coefficient identifies the component of basis variation that remains after removing this common factor, thus isolating the variation that is uniquely informative about Japanese-investor demand. The finding that JPY-orthogonal-to-common variation independently moves AAA spreads rules out an alternative in which the basis acts as a proxy for global dollar funding conditions rather than for Japanese-specific funding.

4.4 Basis versus the Rate Differential

A further concern may be that the basis proxies for a yield-chasing motive operating through the US–Japan interest rate differential rather than through the FX-funding-cost channel we propose. Specifically, Japanese banks may tilt toward dollar assets simply when US yields rise relative to domestic yields, and if the basis co-moves with that dif-

[12]PC1 loadings are nearly equal across the three currencies (JPY = 0.59, EUR = 0.59, GBP = 0.56), consistent with PC1 capturing a general dollar-funding factor common to all major creditor currencies.

ferential, it would confound the funding-cost channel with the yield-chasing channel. We separate the two at the AAA tranche level. Table 5 regresses tranche-level AAA spreads and AAA tranche size on the JPY-USD basis alone and on the basis together with the US 5Y–JP 5Y rate differential. The basis coefficient is negative on spread and positive on quantity, large in magnitude, and barely changes when the rate differential is added in columns (2) and (4). The rate differential itself enters with the expected sign in both outcomes, consistent with yield-chasing demand. The two channels thus operate independently in the data: the FX-funding-cost channel captured by the basis is not subsumed by the rate-differential channel.

Collectively, the placebo markets in Section 4.2, the currency horserace in Section 4.3, and the rate-differential robustness here show that the basis-spread relationship is specific to the U.S. CLO market and the JPY-USD basis, consistent with a marginal-investor channel in which Japanese banks fund their CLO positions through JPY-USD FX swaps.

4.5 Robustness Across Basis Tenors

The results above use the 5-year basis as the investment-horizon-matched FX funding measure for AAA tranches, whose effective lives run roughly 5–7 years. To confirm that the basis-spread relationship is not an artifact of this tenor choice, Appendix Table C.2 re-estimates the same specification at three additional short tenors (3M, 6M, and 1Y). The relationship holds at every tenor. The basis coefficient is negative on AAA spread, with magnitudes rising monotonically as tenor lengthens, consistent with the longer-tenor basis being the relevant investment-horizon-matched proxy for the FX funding cost on a multi-year CLO AAA position.

4.6 Preview: A Shifting Relationship

The aggregate regressions in Tables 1 and 2 pool the entire 2012–2025 sample. But the time-series plots hint at a structural break. Figure 5 makes this break visually transparent. A scatter plot of the AAA spread against the basis, with observations colored by three periods: pre-February 2019 (navy circles), March 2019 through October 2023 (cranberry triangles), and post-November 2023 (green diamonds).[13] After 2019 March, the slope is visibly steeper – nearly a threefold increase in sensitivity, and these post-2019 observations cluster more tightly around their regression line. After November 2023, the slope

[13] We highlight 2020 COVID observations as gold squares.

flattens again: the green diamonds trace a shallower line than the 2019–2023 triangles, though still steeper than the pre-2019 regime, a partial reversal that Section 6.2 quantifies.

This regime shift poses a puzzle. If the basis merely proxies for omitted macroeconomic conditions, one would expect a stable relationship over time. The abrupt change in sensitivity at a specific date instead points to a change in market structure, specifically, in how funding costs transmit into CLO pricing. The model in Section 5 generates this regime shift as an endogenous consequence of shocks to the demand elasticity of Japanese investors. Section 6 tests this prediction formally, exploiting three independent sources of variation: two quasi-natural experiments and recurring quarter-end reporting cycles.

5 Model

We develop a two-market equilibrium model that links the pricing of CLO AAA tranches to the cross-currency basis through the portfolio decisions of Japanese banks. The model features two interconnected markets, the CLO AAA market and the FX funding market, and three classes of agents whose interactions determine equilibrium prices in both markets simultaneously.

Our approach draws on the "market macrostructure" concept of Haddad and Muir (2025), which characterizes equilibrium asset pricing through the institutional constraints and portfolio rules of key market participants. Our key innovation is to model a marginal investor that is common to two seemingly distant markets. Our modeling of that linkage follows framework developed in Du and Huber (2024) and An and Huber (2026) for FX funding, where funding prices and quantities are jointly determined in equilibrium.

5.1 Setup

Agents. Three classes of agents participate across two markets.

Japanese banks invest in dollar-denominated CLO AAA tranches funded with yen liabilities. They can obtain the dollar required for the CLO purchase either by borrowing directly in dollar, or synthetically by swapping yen into dollar through FX derivatives. Empirically, Japanese banks are predominantly funded using synthetic FX funding. The economic cost of using yen to fund dollar is the difference between these two funding technologies, and is precisely the negative of the cross-currency basis that we have defined. Japanese banks' decision to invest in CLOs thus depends on the return from CLO and the cost of FX funding.

CLO managers supply AAA tranches by structuring pools of leveraged loans. Although the size of an individual CLO conforms to industry standard and does not vary over time, managers nonetheless influence overall AAA issuance by deciding whether or not to issue and the relative share of the AAA tranche within an individual CLO. A portion of the total CLO supply is absorbed by domestic US investors such as local banks, insurance companies, and CLO exchange-traded funds, whose decisions are independent of FX funding conditions.[14]

Global dealers intermediate the FX derivatives market, warehousing the currency mismatch between yen-funded and dollar-funded counterparties. Intermediation is costly as dealers face leverage constraints, capital requirements, and balance-sheet capacity limits. These costs create deviations from covered interest-rate parity (CIP) and a non-zero economic cost of synthetic FX funding.

Markets. The two markets are:

(i) The *CLO AAA market*, which clears at issuance spread s (the discount margin over the benchmark floating rate). A wider spread corresponds to a lower price and more favorable returns to investors.

(ii) The *FX funding market*, which clears at cross-currency basis x. The basis summarizes the cost of converting yen funding into dollars via FX derivatives and the *lower* the x, the more of a *premium* Japanese banks pay to obtain synthetic dollar funding.

5.2 Demand and Supply in CLO and FX Funding

Japanese banks' demand. Consider a Japanese bank i that chooses its holdings $q_{it} \geq 0$ of U.S. CLO AAA tranches. Taking into account the cost of synthetically funding dollars using FX derivatives, bank i's profit per unit of CLO exposure is

$$m_{it} \equiv s_t + \kappa_i x_t, \tag{1}$$

where $\kappa_i \in [0, 1]$ captures bank i's FX funding intensity. Recall that x_t is the incremental cost of obtaining dollars synthetically by swapping yen rather than funding directly in dollar markets, where a higher x_t corresponds to cheaper synthetic dollar funding. For simplicity, we assume that non-FX funding costs co-move with the dollar risk-free rate

[14] See Section 2.1 for a discussion of why US domestic investors' CLO demand is approximately inelastic with respect to FX funding conditions.

and are therefore normalized to 0, as the CLO return is stated also as a spread over the dollar risk-free rate.

CLO exposure consumes regulatory capital. Let ω_t denote the relevant regulatory risk weight applied to CLO AAA tranches. The bank faces a shadow cost of regulatory capital λ_{it}, which is increasing in its CLO exposure as higher exposure pushes the bank closer to binding regulatory constraints. We capture this with

$$\lambda_{it}(q_{it}) = \bar{\lambda}_{it} + \psi_i\,\omega_t q_{it}, \qquad \psi_i \geq 0, \tag{2}$$

where ψ_i is the bank-specific shadow cost for each unit of CLO so that overall regulatory shadow cost (λ_{it}) is convex in CLO investments (q_{it}).

The bank solves

$$\max_{q_{it}\geq 0} \; m_{it}\,q_{it} \;-\; \frac{1}{2}a_i q_{it}^2 \;-\; \omega_t q_{it}\,\lambda_{it}(q_{it}), \tag{3}$$

where $a_i > 0$ captures increasing marginal balance-sheet or portfolio-management costs such as internal risk limits, liquidity management, or other convex intermediation frictions. This is in the spirit of the quadratic "capacity constraint" in An and Huber (2026).

Substituting (1) and (2) into (3), the objective becomes

$$\max_{q_{it}\geq 0} \; (s_t + \kappa_i x_t)\,q_{it} \;-\; \frac{1}{2}\big(a_i + 2\psi_i\omega_t^2\big)q_{it}^2 \;-\; \omega_t\bar{\lambda}_{it}\,q_{it}. \tag{4}$$

The first-order condition for an interior solution is

$$s_t + \kappa_i x_t - \omega_t\bar{\lambda}_{it} - \big(a_i + 2\psi_i\omega_t^2\big)q_{it} = 0, \tag{5}$$

yielding individual demand

$$q_{it}^* = \frac{s_t + \kappa_i x_t - \omega_t\bar{\lambda}_{it}}{a_i + 2\psi_i\omega_t^2}. \tag{6}$$

Equation (6) shows that how demand is affected by spread and by basis depends on $a_i + 2\psi_i\omega_t^2$. This sensitivity is governed by the interaction between risk weights (ψ_t) and shadow cost (ψ_i). We note that while banks in the model face the same risk weights, they could differ in the regulatory shadow cost they attach to CLO holdings (ψ_i).

Aggregation and composition of demand. Let A_t denote the set of Japanese banks active in the CLO AAA market at time t. Aggregate Japanese demand is

$$Q_t^{JP} = \sum_{i\in A_t} q_{it}. \tag{7}$$

Using (6), aggregate demand can be written as

$$Q_t^{JP} = \alpha_t + \eta_t s_t + \kappa_t x_t, \tag{8}$$

where

$$\eta_t \equiv \sum_{i \in A_t} \frac{1}{a_i + 2\psi_i \omega_t^2}, \tag{9}$$

$$\kappa_t \equiv \sum_{i \in A_t} \frac{\kappa_i}{a_i + 2\psi_i \omega_t^2}, \tag{10}$$

$$\alpha_t \equiv - \sum_{i \in A_t} \frac{\omega_t \bar{\lambda}_{it}}{a_i + 2\psi_i \omega_t^2}. \tag{11}$$

Equations (9)–(11) show that the aggregate demand sensitivity to spread, η_t, and aggregate demand sensitivity to basis, κ_t, are both functions of institution-level sensitivities. Changes in the shadow cost ψ_i alter these sensitivities mechanically, while shocks that shift participation or composition (changes in A_t) modify η_t and κ_t by changing which institutions' shadow cost matter.

For expositional simplicity, we assume a common FX-funding intensity across active banks, $\kappa_i = \bar{\kappa}$. This assumption abstracts from cross-sectional variation in funding mix to emphasize the importance of ψ_i in driving both κ_t and η_t. Under this simplification, the reduced-form sensitivity of CLO demand to funding conditions satisfies $\kappa_t = \bar{\kappa}\eta_t$.

Residual CLO supply. CLO managers issue AAA tranches based on the spread they can offer relative to the benchmark floating rate. The lower the spread, the more profitable the CLO is for the manager, and the more willing the manager is to supply. Residual supply, the quantity available to Japanese banks after domestic US demand is absorbed, is therefore

$$Q_t^{CLO} = \bar{Q}_t^{CLO} - \xi s_t, \tag{12}$$

where $\xi \geq 0$ captures the responsiveness of issuance to spreads.

We note that the residual supply curve features only s and not x. This reflects that CLO managers' issuance decisions are directly driven by US credit market conditions and not FX funding conditions. However, FX funding conditions can still affect CLO quantities in equilibrium through market clearing.

Residual FX funding supply. Japanese banks must also obtain dollar funding from global FX intermediaries. Let the residual supply of dollar funding via FX derivatives, after netting out other market participants, be:

$$Q_t^{FX} = \bar{Q}_t^{FX} - \nu_t x_t, \tag{13}$$

where $\nu_t > 0$ captures the responsiveness of intermediaries' funding supply to funding conditions. Because higher x_t corresponds to cheaper funding and thus lower proceeds to intermediaries, funding supply decreases in x_t.

5.3 Equilibrium and Pass-through

An equilibrium is a pair (s^*, x^*) such that the CLO market and the FX funding market both clear:

$$Q_t^{JP} = Q_t^{CLO} = Q_t^{FX}/\bar{\kappa}. \tag{14}$$

Using equations (6) and (12), equilibrium in the CLO market implies:

$$\alpha_t + \eta_t s_t + \kappa_t x_t = \bar{Q}_t^{CLO} - \xi s_t. \tag{15}$$

Solving yields the equilibrium spread as a function of funding conditions:

$$s_t(x_t) = \frac{\bar{Q}_t^{CLO} - \alpha_t}{\eta_t + \xi} - \frac{\bar{\kappa}\eta_t}{\eta_t + \xi} x_t. \tag{16}$$

The implied equilibrium quantity in the CLO market is thus

$$Q_t(x_t) = \bar{Q}_t^{CLO} - \xi\, s_t(x_t) \tag{17}$$

$$= \bar{Q}_t^{CLO} - \xi \frac{\bar{Q}_t^{CLO} - \alpha_t}{\eta_t + \xi} + \xi \frac{\bar{\kappa}\,\eta_t}{\eta_t + \xi}\, x_t. \tag{18}$$

Equations (16) and (18) show how, because of Japanese banks' demand in both the CLO market and the FX funding market, the equilibrium price and quantity in CLO is intimately connected to the equilibrium price in FX funding.

Differentiating (16) and (18), we obtain

$$\frac{\partial s_t}{\partial x_t} = -\frac{\bar{\kappa}\,\eta_t}{\eta_t + \xi}, \tag{19}$$

$$\frac{\partial Q_t}{\partial x_t} = \xi\, \frac{\bar{\kappa}\,\eta_t}{\eta_t + \xi}. \tag{20}$$

As $\bar{\kappa} > 0$, $\xi \geq 0$, and $\eta_t > 0$, the model directly predicts that CLO spreads decline ($\partial s_t / \partial x_t < 0$) but quantities increase ($\partial Q_t / \partial x_t > 0$) when funding becomes cheaper (higher x_t).

5.4 Strength of pass-through and its determinants

To examine how the magnitude of pass-through from funding conditions to CLO spreads and quantities is governed by η_t, the Japanese banks' demand sensitivity for CLO, we derive the following mixed partials:

$$\frac{\partial^2 s_t}{\partial x_t \, \partial \eta_t} = -\bar{\kappa} \, \frac{\xi}{(\eta_t + \xi)^2} \leq 0, \tag{21}$$

$$\frac{\partial^2 Q_t}{\partial x_t \, \partial \eta_t} = \bar{\kappa} \, \frac{\xi^2}{(\eta_t + \xi)^2} \geq 0. \tag{22}$$

Comparing equation (21) to equation (19), and equation (22) to equation (20), we see that as η_t increases, the negative relationship between $\partial s_t / \partial x_t$ and the positive relationship between $\partial Q_t / \partial x_t$ are both stronger.

We summarize how FX funding and US CLO are connected in equilibrium in the following proposition.

Proposition 5.1 (Aggregate determinants of funding pass-through to spreads and quantities)**.** *Assume $\bar{\kappa} > 0$, $\xi \geq 0$, and $\eta_t > 0$.*

1. *CLO spreads are decreasing in funding conditions:*

$$\frac{\partial s_t}{\partial x_t} = -\frac{\bar{\kappa} \, \eta_t}{\eta_t + \xi} < 0.$$

2. *CLO quantities are increasing in funding conditions:*

$$\frac{\partial Q_t}{\partial x_t} = \xi \, \frac{\bar{\kappa} \, \eta_t}{\eta_t + \xi} \geq 0,$$

   with strict inequality when $\xi > 0$.

3. *The magnitude of spread pass-through weakly increases with demand elasticity:*

$$\frac{\partial}{\partial \eta_t} \left| \frac{\partial s_t}{\partial x_t} \right| = \bar{\kappa} \, \frac{\xi}{(\eta_t + \xi)^2} \geq 0.$$

Equivalently, $\partial^2 s_t / (\partial x_t \, \partial \eta_t) \leq 0$*.*

4. *The quantity sensitivity to funding conditions also weakly increases with demand elasticity, albeit at a slower rate when* $\xi < 1$*:*

$$\frac{\partial^2 Q_t}{\partial x_t \, \partial \eta_t} = \bar{\kappa} \, \frac{\xi^2}{(\eta_t + \xi)^2} \geq 0.$$

Proposition 5.1 illustrates that the pass-through from FX funding conditions to US CLO pricing need not be stationary but is affected by Japanese banks' CLO demand sensitivity, η.

Importantly, η_t is the aggregate demand sensitivity of Japanese banks (Equation (9)), and it is therefore changed when the institutions that comprise the banking sector are affected. Specifically, although all banks have the same baseline preference over the spread they can earn on CLOs, differences in their regulatory shadow cost and/or convexity cost lead to differences in their demand sensitivity. When, for example, the regulatory cost of CLO holdings rises unevenly across institutions, the weight in the active market shifts away from high-cost, inelastic banks (high ψ_i, high a_i) toward banks with more scalable balance-sheet capacity, raising the aggregate η_t.

We derive further results on how shocks to individual banks affect the strength of funding pass-through.

Proposition 5.2 (Determinants of η_t)**.** *Let* η_t *be defined by* (9)*, and define spread pass-through*

$$\Pi_t \equiv \frac{\partial s_t}{\partial x_t} = -\frac{\bar{\kappa} \, \eta_t}{\eta_t + \xi}, \qquad \bar{\kappa} > 0, \ \xi \geq 0, \ \eta_t > 0.$$

Then:

1. *(*Primitives.*) For any active bank* $i \in A_t$*, the individual spread elasticity satisfies*

$$\frac{\partial}{\partial a_i}\left(\frac{1}{a_i + 2\psi_i \omega_t^2}\right) < 0, \quad \frac{\partial}{\partial \psi_i}\left(\frac{1}{a_i + 2\psi_i \omega_t^2}\right) < 0, \quad \frac{\partial}{\partial \omega_t}\left(\frac{1}{a_i + 2\psi_i \omega_t^2}\right) < 0.$$

   Accordingly, holding the active set A_t *fixed,* η_t *is decreasing in each of* a_i*,* ψ_i*, and* ω_t*.*

2. *(*Composition.*) A change in the active set* A_t*, or in the relative weights of banks within it, alters* η_t *through differences in their denominators* $(a_i + 2\psi_i \omega_t^2)$*. In particular, composition shifts that increase the weight of banks with lower* $(a_i + 2\psi_i \omega_t^2)$ *increase* η_t*.*

As Proposition 5.1 shows, the effect of demand sensitivity on the strength of pass-through to quantity is qualitatively similar to the effect on the strength of pass-through to price. Proposition 5.2 therefore also applies to quantity pass-through, albeit at a possibly different intensity if $\xi \neq 1$.

6 Identification

The model in Section 5 makes a symmetric prediction: the pass-through from FX funding conditions to CLO pricing should increase when aggregate Japanese demand becomes more elastic and decrease when it becomes less elastic. We test this prediction using three independent sources of variation. We first exploit two quasi-natural experiments: Japan's implementation of Basel III securitization risk weights in 2019 plausibly increased the aggregate demand elasticity (Section 6.1), and the Bank of Japan's November 2023 policy normalization plausibly reduced the elasticity (Section 6.2). We then use quarter-end assessment of regulatory capital to conduct a higher-frequency test of the effect of aggregate demand elasticity (Section 6.4). All three tests identify the same underlying mechanism of demand elasticity modulating the strength of pass-through between distant markets.

6.1 Natural Experiment 1: JFSA Basel III Securitization Rules (March 2019)

6.1.1 Institutional Background

In December 2018, the Japan Financial Services Agency published draft amendments to its banking capital requirements implementing the Basel III securitization framework. After a brief public comment period, the JFSA adopted the final rules on March 15, 2019, effective March 31, 2019.[15] The regulation imposed two distinct cost increases on Japanese banks holding CLO positions: a risk retention requirement backed by punitive risk weights, and heightened due diligence obligations that substantially increased the operational burden of CLO investment.

Under the revised framework, Japanese banks investing in securitization exposures were required to verify that the *originator* of the underlying assets, or a sponsor or arranger "deeply involved" in the securitization process, had retained at least 5% of the

[15] The JFSA simultaneously published responses to public comments and a series of Q&As providing interpretive guidance. See Nolan and Sako (2019) and Williams et al. (2019) for detailed analyses of the rule.

credit risk of the securitized pool, in vertical, horizontal, or L-shaped form. For exposures that failed this verification, the JFSA tripled the applicable risk weights.[16]

For US CLOs, compliance with the originator retention requirement was difficult as CLO managers are not the originators of the underlying leveraged loans. CLOs acquire loans in the secondary market on behalf of the CLO issuing entity. In the United States, the Dodd-Frank Act's risk retention rules had briefly required CLO managers to retain a 5% interest, but the D.C. Circuit's February 2018 ruling in *Loan Syndications and Trading Association v. SEC* held that open-market CLO managers are not "securitizers" under the statute and therefore have no retention obligation.[17] The US risk retention regime for open-market CLOs was thus effectively vacated one year before the JFSA rule took effect, creating a sharp divergence: at the moment Japan imposed its retention requirement, no analogous obligation existed in the United States.

The JFSA rule did provide an exception for cases where the bank could demonstrate, through independent analysis of the underlying assets and the manager's investment criteria, that "no improper original assets are structured." In practice, however, satisfying this exception required Japanese banks to conduct loan-level reviews of the CLO's collateral portfolio, a substantial due diligence burden given that a typical BSL CLO holds 200–300 individual leveraged loans originated by dozens of arranging banks.[18]

Motivating evidence. The regulation's impact is visible in aggregate quantities. Japanese banks' CLO holdings, which had grown at a compound annual rate of approximately 36% between fiscal years 2015 and 2018 (from ¥5.1 to ¥12.8 trillion), decelerated to approximately 6% per year after 2019, a sixfold slowdown shown in Figure 1 and Appendix Figure B.3.The Japanese share of US CLO AAA tranches declined from its 2019 peak of approximately 35% to roughly 20% by 2024, as domestic US institutions and CLO ETFs absorbed the margin, as shown in Figure 2. We now examine whether this demand shift altered the transmission from funding costs to CLO pricing.

[16]Specifically, the risk weight for non-compliant securitization exposures was multiplied by a factor of three. For a AAA-rated CLO tranche that would otherwise receive a risk weight of approximately 15–20% under the internal ratings-based approach, the penalty risk weight rose to 45–60%, still well below the maximum 1,250% risk weight applied to unrated or re-securitization exposures, but a substantial increase in required capital. For lower-rated tranches, the penalty could bind more tightly.

[17]No. 17-5004 (D.C. Cir. Feb. 9, 2018). The court found that CLO managers, who direct asset acquisitions on behalf of the issuing entity through open-market purchases, do not "sell or transfer" assets to the issuer and therefore fall outside the statutory definition of securitizer. The government did not appeal.

[18]Unlike the EU risk retention regime, which requires the *originator* (or sponsor or original lender) to retain a 5% interest and places the compliance burden primarily on the sell side, the JFSA rule placed the verification burden squarely on the *investing* bank. The consequence of non-compliance was also harsher under the Japanese framework: risk weight tripling, versus potential regulatory sanction but no automatic capital penalty under the EU approach.

6.1.2 Relevance and identification properties

Two aspects of the rule's scope are important for the design of our test. First, the regulation applied only to securitization exposures *acquired after* March 31, 2019; it was not retroactive to existing portfolio holdings. The cost increase thus operated primarily on the flow of new Japanese demand, directly affecting the CLO issuance market that we study. Second, the regulation applied uniformly to all Japanese banks supervised by the JFSA, including the megabanks (MUFG, SMFG, Mizuho), trust banks, and the cooperative banking system (Norinchukin). Because the rule applied only to CLO holdings, it bore most heavily on the concentrated, price-insensitive holder at the top of the market, shifting weight within the Japanese investor base toward more elastic buyers, a compositional change we document directly in Section 6.1.4.

Several additional features of the March 2019 shock make it attractive for identification. First, the timing is sharp: the draft rule was published in December 2018, finalized on March 15, 2019, and took effect on March 31, 2019, providing clean pre-announcement and post-implementation event dates. Second, the regulation was specific to Japanese prudential policy, driven by the Basel III implementation calendar and JFSA's supervisory stance, and plausibly exogenous to conditions in the US leveraged loan and CLO markets. As such, the regulation plausibly operated *exclusively* through the demand side: it raised the cost of holding CLOs for Japanese banks but did not affect CLO supply, which is determined by leveraged loan origination, warehouse financing, and structuring economics. Third, the regulation was specific to holdings of CLO and likely did not directly alter conditions in FX swap markets, which are governed by global intermediaries' balance sheet constraints and global dollar funding dynamics. These features allow us to directly test the model, which links the strength of pass-through between FX funding and the CLO market to the demand sensitivity of Japanese banks.

6.1.3 Tranche-Level Evidence

Table 6 exploits cross-sectional variation across AAA tranches issued in a five-year window around the Basel III implementation (2017–2021). Estimating at the tranche level allows us to compare securities issued by the same manager before and after the reform, avoiding spurious changes driven by shifts in issuer composition. The estimating equation is:

$$y_{i,t} = \beta_1 \,\text{Basis}_t + \beta_2 \,\text{Post}_t + \beta_3 \,(\text{Basis}_t \times \text{Post}_t) + \delta_{m(i)} + \delta_{y(t)} + \delta_{c(i)} + \delta_{a(i)} + \varepsilon_{i,t}, \quad (23)$$

where $\text{Post}_t = \mathbf{1}[t \geq \text{March 2019}]$ corresponds to the JFSA's Basel III effective date, and $\delta_{m(i)}$, $\delta_{y(t)}$, $\delta_{c(i)}$, and $\delta_{a(i)}$ denote manager, year, coupon-base-rate, and arranger fixed effects, added progressively across columns. Column (1) includes manager fixed effects. Column (2) adds year fixed effects. Column (3) adds benchmark fixed effects. Column (4) adds arranger fixed effects. Because Basel III was implemented in March 2019, the year fixed effects do not absorb the Post main effect in this specification.

Panel A reports spread results. The coefficients on the basis are negative and significant across all specifications: cheaper FX funding compresses AAA spreads, consistent with Proposition 5.1. The interaction coefficients range from -1.44 to -1.86 and are significant at the 1% level throughout. In the preferred specification (column 4), a 10-basis-point improvement in the basis is associated with an additional 18.6 basis points of spread response after 2019.[19] Figure 5 visualizes this regime shift: the slope of AAA spreads on the basis steepens sharply after Basel III, with post-Basel III observations (cranberry triangles) lying along a visibly steeper regression line than pre-2019 observations (navy circles).

Panel B reports results for AAA tranche size. The interaction is positive and significant across columns, indicating that tranche sizes also became more responsive to funding conditions after the regulatory shock. The direction mirrors the spread result: both prices and quantities exhibit amplified pass-through when demand is more elastic.

6.1.4 Decomposing the Aggregate Elasticity Change: Compositional Shift

Why did the aggregate elasticity rise? We argue that the rise reflected a *compositional* change: the inelastic anchor of the Japanese investor base lost weight, leaving a residual base with more elastic demand. The two panels of Figure 6 provide direct evidence for this decomposition.

First, Norinchukin, the "CLO whale" of Section 2.2, is the inelastic anchor of the Japanese investor base. To investigate institution-level demand elasticity, we estimate the sensitivity of CLO acquisitions to the cross-currency basis. Because the basis is determined in the FX market, it is less susceptible to endogeneity than CLO spreads. Figure 6a reports buyer-level basis-elasticities estimated over the pre-Basel III window (2013–2018), separately for Norinchukin and for the residual rest-of-market buyer pool. Norinchukin's CLO absorption is statistically uncorrelated with the basis ($\beta = 0.04$, not significant),

[19] Because the specification includes year fixed effects, the main effect of the basis is identified from within-year variation. The insignificant coefficient therefore indicates limited within-year pass-through before 2019. Section 6.1.4 shows that this pattern is consistent with the dominant role of the relatively inelastic Norinchukin bank during this period.

whereas rest-of-market absorption is strongly positive ($\beta = 0.60$, significant at the 1% level), a difference of roughly a factor of 15. The single largest holder is thus price-insensitive, while the rest of the Japanese base sets demand at the margin.

Second, Basel III diluted the weight of this anchor. Figure 6b plots Norinchukin's share of total Japanese CLO holdings at each fiscal year-end. The share peaked at 55.0% in March 2019, exactly when the Basel III SEC-SA framework became effective for Japanese banks, and then fell monotonically to 38.5% by March 2024, a roughly 16 percentage-point drop. Norinchukin's own holdings stayed broadly flat after the shock; its falling share reflects megabanks expanding CLO exposure around a static anchor.

Together, the two panels pin down the source of the aggregate elasticity change. The price-insensitive CLO whale lost nearly a third of its weight in the Japanese investor pool, and that weight passed to the elastic, basis-sensitive megabanks. A rising share of elastic demand raises η_t, even as total Japanese ownership of AAA tranches declined. The compositional channel of Proposition 5.2, that is, inelastic demand losing weight to elastic demand, is thus directly observed in the data.

6.2 Natural Experiment 2: BOJ Policy Normalization (2023–2024)

Our first natural experiment showed that a shock *increasing* aggregate demand elasticity amplifies basis pass-through. A sharp test of the mechanism is whether a shock moving elasticity in the *opposite* direction dampens it. The Bank of Japan's 2023–2024 policy normalization provides exactly this: an increase in the domestic outside option that raises the shadow cost of CLO investment uniformly across Japanese banks, compressing aggregate demand elasticity.

6.2.1 Institutional Background

Between October 2023 and March 2024, the Bank of Japan undertook a fundamental shift in monetary policy. In October 2023, the BOJ effectively abandoned its yield curve control (YCC) policy by redefining the 1% cap on 10-year JGB yields as a "reference point" rather than a rigid ceiling.[20] In March 2024, the BOJ raised the policy rate for the first time in 17 years, ending the negative interest rate regime. Together, these actions represented the most significant tightening of Japanese monetary policy in a generation.

[20] The BOJ had introduced YCC in September 2016, initially targeting the 10-year JGB yield at approximately 0%. The cap was gradually loosened: from ±0.25% in December 2022, to ±0.50% in July 2023, and then effectively removed in October 2023 when the BOJ characterized the 1% level as a reference rather than a ceiling. The 10-year JGB yield subsequently rose above 0.9% and has traded between 0.8% and 1.1% since.

By raising domestic yen bond yields, the policy normalization increased the attractiveness of the outside option for Japanese banks. Yen-denominated government bonds, which had offered near-zero or negative yields for nearly a decade, suddenly became a viable alternative to dollar-denominated CLO investments that require costly FX funding. Unlike the Basel III shock, which raised regulatory costs heterogeneously and shifted weight away from the inelastic anchor, the BOJ normalization raised the opportunity cost of CLO investment across all Japanese institutions. In the model, this increase of opportunity cost raises ψ_i and lowers aggregate demand elasticity η_t. Thus, the model predicts that the BOJ shock should *weaken* the pass-through from funding conditions to both CLO spreads and quantities.

A key feature of the BOJ shock is that it increased the opportunity cost of holding CLOs without changing banks' overall capitalization. One potential concern is that the improved attractiveness of domestic government bonds could have induced banks to reallocate toward lower-risk-weight assets, thereby increasing their regulatory capital and, if anything, making aggregate demand more elastic rather than less. Figure 7 shows that this concern is not borne out in the data: Common Equity Tier 1 (CET1) capital ratios remain essentially unchanged throughout the normalization period for the four major Japanese banks active in the U.S. CLO market—MUFG, SMFG, Mizuho, and Norinchukin.

6.2.2 Difference-in-Differences

Table 7 reports difference-in-differences estimates in a five-year window (2021–2025), with Post equal to one from November 2023 onward. The sample is AAA-rated US CLO tranches. The estimating equation follows Equation (23), with $\text{Post}_t = \mathbf{1}[t \geq \text{Nov 2023}]$. Column (1) includes manager fixed effects. Column (2) adds year fixed effects. Column (3) adds benchmark rate fixed effects. Column (4) adds arranger fixed effects.

Panel A reports spread results. The main effect of the basis is negative and strongly significant, with a magnitude of approximately -2.2 in the preferred specification (column 4), much larger than the Basel III pre-period coefficient (a statistically insignificant -0.30), reflecting the already-steepened post-2019 regime that serves as the baseline for this test. The interaction coefficient is positive and significant across all specifications, ranging from 0.74 to 1.48. The positive sign indicates that basis pass-through to spreads *weakened* after the BOJ shock: the post-normalization slope, while still strongly negative, is approximately 34% shallower than the pre-normalization slope. This is the mirror image of the Basel III result, where the interaction was negative (stronger pass-through), and is precisely what the model predicts when demand becomes more inelastic. Basel III reweighted the Japanese investor base toward more elastic buyers, amplifying pass-through. The BOJ normalization, by contrast, raised the outside option uniformly, increasing the shadow cost of CLO investment across all Japanese banks and compressing aggregate demand elasticity. This is consistent with Figure 5, which shows the post-November 2023 observations trace out a shallower slope than the 2019–2023Q3 observations.

Panel B reports results for the AAA tranche size. The main effect of the basis is positive and significant: cheaper funding is associated with larger tranches, consistent with Proposition 5.1. The interaction is negative and significant across all specifications, indicating that tranche sizes also became less responsive to funding conditions after the BOJ shock. Both price and quantity pass-through weakened in the same direction, consistent with a reduction in aggregate demand elasticity η_t.

The two natural experiments thus move the same structural parameter, aggregate demand elasticity η_t, in opposite directions through distinct mechanisms: Basel III increases η_t by reweighting the investor base toward elastic buyers, while BOJ normalization decreases η_t via a uniform increase in the outside option. The model's predictions are confirmed in both directions.

6.3 Cross-Rating Evidence

A natural concern is that the basis moves CLO spreads through broad credit-market or dollar-funding forces common to all tranches, rather than through Japanese demand specific to AAA. We address this by comparing AAA against BBB tranches of the same deals. BBB is a natural benchmark: it is exposed to the same collateral pool, the same deal structure, and the same aggregate credit and funding conditions as AAA, but it is priced by domestic credit-focused clienteles for whom the JPY-USD basis is not a funding cost. If the change in pass-through documented in our two natural experiments reflects a general credit-market channel, it should appear equally in AAA and BBB. If instead it operates through Japanese demand, it should be concentrated in AAA, where Japanese banks are the marginal investor, and largely absent in BBB. We therefore estimate the basis pass-through slope separately for AAA and BBB in each natural-experiment window and compare the ratio of post-event to pre-event slopes.

Figure 8 plots these amplification ratios. Panel (a) reports the Basel III result. Both AAA and BBB slopes steepen after the reform, consistent with some degree of structuring-induced spillover across the capital structure, but the amplification is substantially larger for AAA than for BBB. The gap between the two is the object of interest: the change in pass-through is concentrated where Japanese banks price, exactly as the demand channel predicts. The change in BBB's pass-through is consistent with an indirect structuring channel. Because AAA accounts for roughly two-thirds of deal liabilities, a shock to AAA pricing alters the economics of the deal as a whole; to preserve target returns across the capital structure, CLO managers reallocate spreads across the remaining tranches, so that some of the AAA shock is transmitted downward.[21]

Panel (b) reports the BOJ result and shows the mirror image. AAA pass-through attenuates after the normalization, while the BBB slope is essentially unchanged, if anything moving slightly in the opposite direction. Again the movement is concentrated in AAA, the tranche where Japanese banks are marginal, and the benchmark tranche barely responds. In both experiments, then, the tranche priced by Japanese banks moves sharply in the model-predicted direction while the benchmark tranche moves comparatively little.

Across both experiments, the AAA–BBB comparison localizes the basis transmission channel to the top of the capital structure, exactly where Japanese banks concentrate their holdings. Because BBB absorbs the same collateral, structuring, and macro conditions as AAA, the divergence between them cannot be explained by forces that would affect AAA and BBB equally.

6.4 Quarter-End Effects

The two quasi-natural experiments exploit discrete regulatory and policy shocks that permanently altered the demand elasticity of the Japanese investor base, with the Basel III implementation increasing it, and the BOJ normalization decreasing it. We now turn to a source of variation that operates at higher frequency: predictable within-year cycles in regulatory costs driven by balance-sheet reporting.

Japanese banks' regulatory capital is assessed using quarter-end balance-sheet snapshots. As a result, the shadow cost of regulatory capital (ψ_i) spikes at quarter-ends. In the model, a higher ψ_i reduces each bank's demand sensitivity to the spread, lowering the aggregate demand elasticity η_t (Equation 9). Proposition 5.2 then predicts that the magnitude of basis pass-through to both spreads and quantities weakly declines. Intuitively, when the marginal regulatory cost is elevated, a larger increase in expected return

[21] Segmented investor demand and structuring-induced cross-elasticities have been documented in related settings; see Koijen and Yogo (2019), Bretscher et al. (2026), and Haddad et al. (2025).

is required to induce the same quantity of CLO investment, muting the responsiveness of both prices and quantities to funding conditions.

6.4.1 Tranche-Level Evidence

Table 8 reports tranche-level regressions of CLO AAA outcomes on the cross-currency basis, a quarter-end indicator, and their interaction, with progressively saturated fixed effects.

Panel A reports spread results. The main effect of the basis is negative and significant across all specifications: cheaper FX funding compresses AAA spreads, consistent with Proposition 5.1. The interaction term is positive and significant in columns (1) through (3). The coefficient continues to be significant in column (4), where we include year-quarter fixed effects to absorb all quarterly-level variation in the basis. Identification in this specification comes exclusively from within-quarter differences between quarter-end and non-quarter-end months. Together, the evidence shows that the spread-basis relationship is attenuated at quarter-ends. In the preferred specification of column 4, a 10-basis-point improvement in the basis compresses spreads by approximately 5.9 basis points in non-quarter-end months but only by approximately 5.2 basis points at quarter-ends, a roughly 12% reduction in pass-through.

Panel B reports results for log AAA tranche size. The interaction is negative and significant across all four specifications, indicating that the positive relationship between the basis and tranche size is also attenuated at quarter-ends. At quarter-ends, both the price and quantity channels of basis pass-through are dampened, consistent with a temporary reduction in aggregate demand elasticity.

7 Conclusion

This paper studies how foreign investor demand transmits across asset and funding markets, using the CLO market as a laboratory in which the marginal investors, their constraints, and the shocks they face are all observable. Japanese banks hold approximately one-quarter of all US CLO AAA tranches and fund these positions by swapping yen into dollars in FX derivative markets. Their joint presence in both markets creates an equilibrium linkage: the JPY-USD cross-currency basis, determined in the FX funding market, shapes the pricing and issuance of US structured credit. The basis alone explains over 60% of the quarterly variation in CLO issuance volume, and its effect on AAA spreads remains robust to a comprehensive set of US macrofinancial controls.

Our central finding is that the strength of this cross-market transmission is governed by the demand elasticity of the marginal investor, and that this elasticity is itself endogenous to policy. Two quasi-natural experiments demonstrate the mechanism. Japan's 2019 Basel III implementation raised the regulatory cost of CLO investment heterogeneously, shifting weight within the Japanese investor base away from its concentrated, price-insensitive anchor toward more elastic buyers and thereby raising aggregate demand elasticity, which strengthened the pass-through from funding conditions to CLO spreads and quantities. The Bank of Japan's 2023–2024 policy normalization operated in the opposite direction: by raising domestic yen returns, it increased the opportunity cost of CLO investment across all Japanese banks, compressing aggregate demand elasticity and weakening pass-through. The two shocks thus move the same structural parameter in opposite directions, and in both cases the model's prediction is confirmed. Quarter-end balance-sheet reporting cycles corroborate the mechanism at high frequency, as the temporary spike in regulatory shadow costs dampens pass-through within the year.

These findings yield three insights. First, asset market equilibrium and funding market equilibrium are jointly determined when common investors are marginal in both. The literature has largely studied these markets in isolation, documenting the effects of foreign demand on either asset prices or funding conditions, but not the feedback between them. Our two-market framework shows that shocks entering at either node propagate to both prices through the portfolio and funding decisions of Japanese banks. CLO spreads are therefore not determined solely by US credit conditions: the cross-currency basis, originating entirely outside the US credit system, exerts explanatory power that rivals conventional domestic risk factors.

Second, regulatory and monetary policy shocks do not merely shift demand curves; they tilt them. After Basel III, US CLO pricing became *more* sensitive to foreign funding conditions even as Japanese ownership of AAA tranches declined from approximately 35% to 20%. After the BOJ normalization, pass-through weakened even though Japanese banks remained substantial holders. This implies that a market's exposure to foreign capital cannot be inferred from foreign ownership shares alone: what matters is the elasticity of foreign demand, which is itself endogenous to regulation and monetary policy in the creditor country.

Third, the mechanism we document is not specific to CLOs. AAA CLO tranches are highly rated, historically loss-free, floating-rate instruments that function as safe dollar assets for foreign institutions. The same logic, that elasticity of foreign demand governs the transmission of shocks from FX funding to domestic credit supply, should apply to other segments of US fixed income with substantial and concentrated foreign ownership.

Whether Treasuries, agency MBS, or investment-grade corporate bonds exhibit similar joint determination with funding markets, and whether regulatory or monetary shocks in creditor countries reshape their pricing sensitivity, are questions our framework is designed to address.

The policy implications follow directly. Changes in Japanese prudential regulation, BOJ monetary policy, or balance-sheet capacity reshape how forcefully funding shocks transmit to the pricing of new US CLO deals. The post-Basel III regime, in which AAA spreads became substantially more sensitive to the basis, represented a period of heightened exposure of US leveraged credit to shocks originating in the Japanese financial system. The subsequent BOJ normalization partially reversed this sensitivity, illustrating that the exposure is not fixed but fluctuates with the constraints and opportunities facing the marginal investor.

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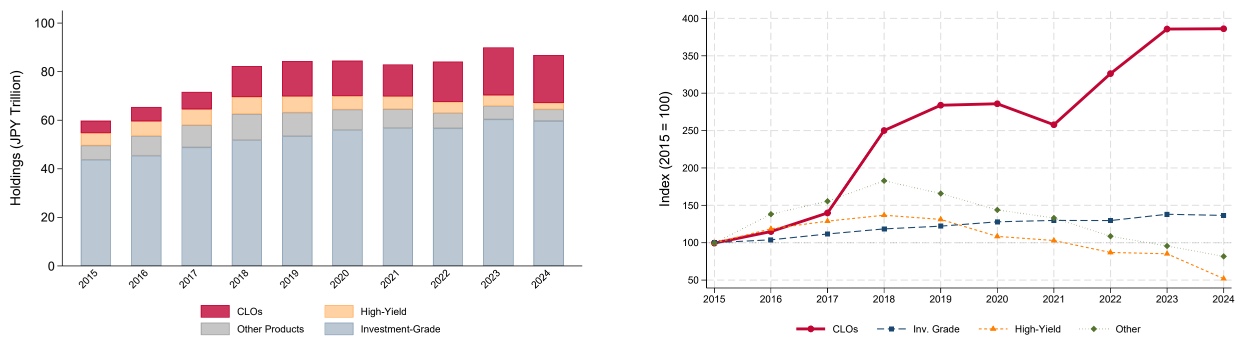
Figures and Tables

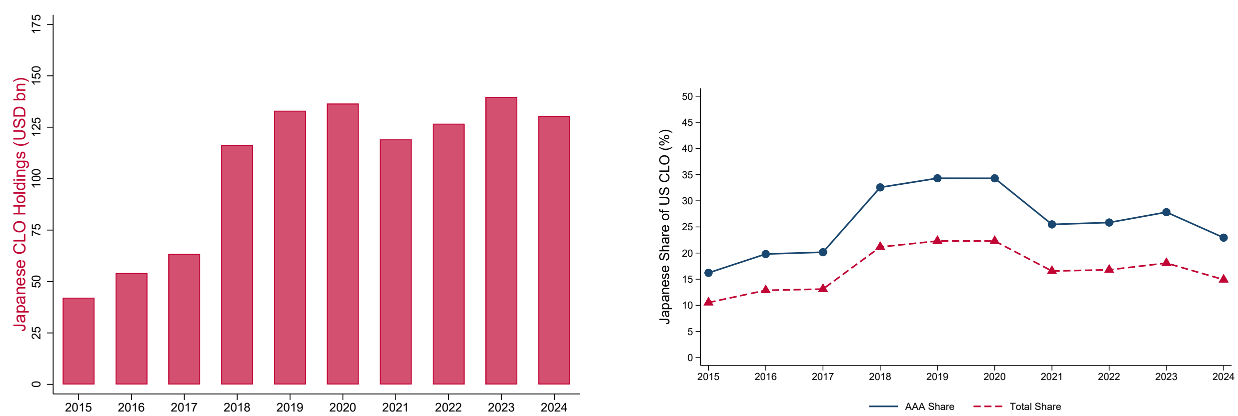
Figure 1: Japanese Banks' Overseas Credit Holdings and CLO Growth



(a) Composition of Overseas Credit (b) Growth by Asset Class (2015 = 100)

Notes: This figure presents Japanese banks' overseas credit holdings using data from the Bank of Japan Financial System Report. Panel (a) shows the composition of holdings across four categories: investment-grade corporates, high-yield corporates, CLOs, and other structured products. Panel (b) indexes each category to 100 in 2015. The dashed vertical line marks Japan's implementation of Basel III risk retention requirements in March 2019.

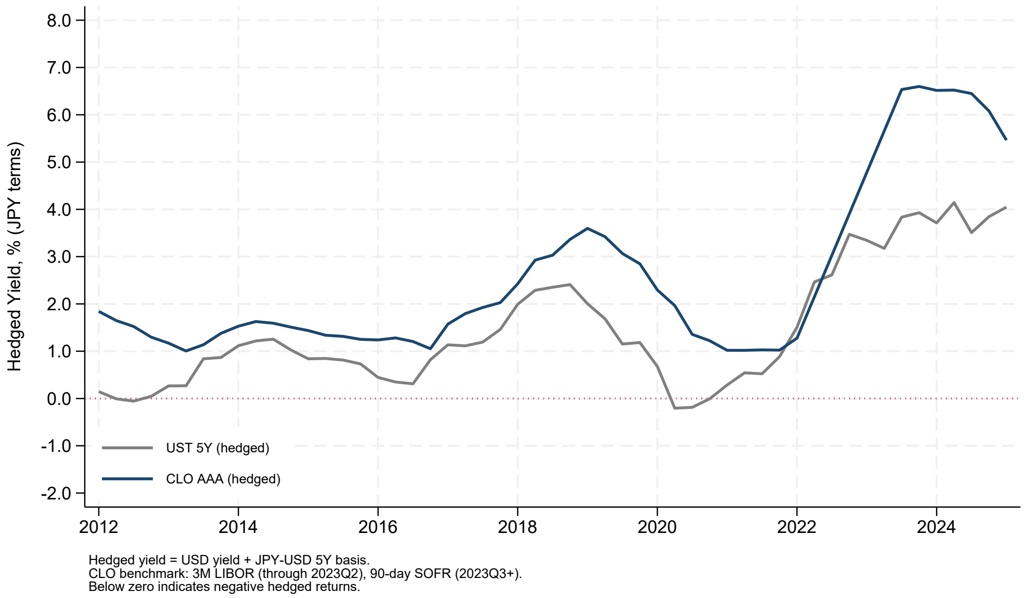
Figure 2: Japanese Banks' Share of the US CLO Market and Concentration of AAA Tranche



(a) Holdings vs. Market Size (b) Share of US CLO AAA Outstanding

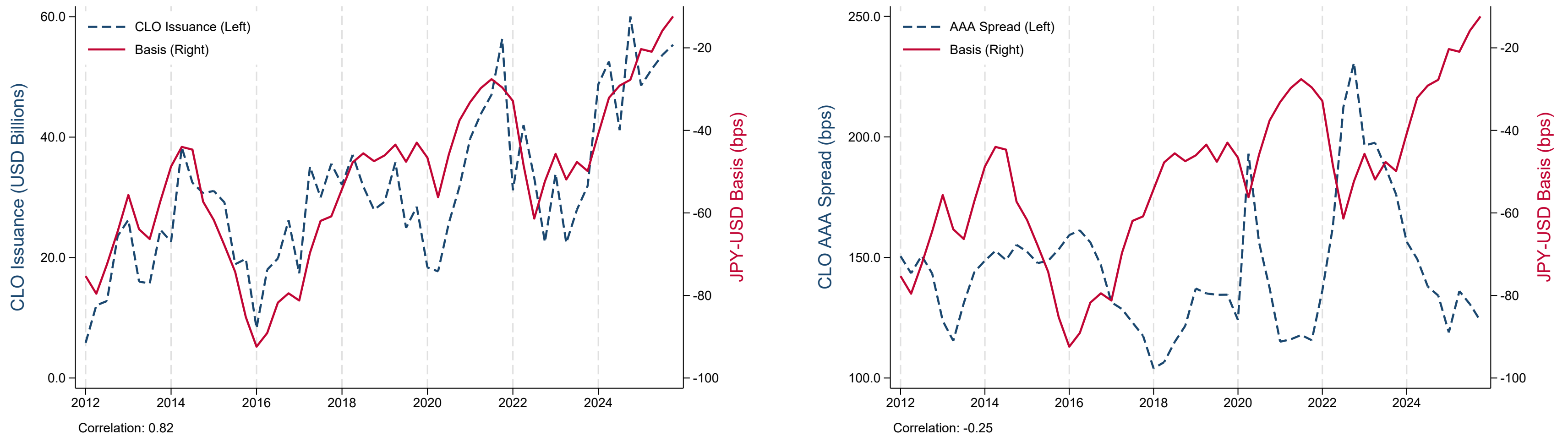
Notes: Panel (a) plots Japanese banks' CLO holdings in USD billions, where outstanding is constructed using a perpetual inventory method with a 13% annual runoff rate applied to issuance data. Panel (b) plots the Japanese share of US CLO AAA outstanding, alongside their share of total US CLO issuance. The solid line adjusts for the fact that Japanese banks also hold European CLOs (estimated at 5–25% of total CLO holdings depending on year); the dashed line shows the unadjusted upper bound.

Figure 3: All-In FX-Funded Yields for Japanese Investors



Notes: This figure plots the yield, after accounting for FX funding, on two dollar assets available to Japanese banks: five-year US Treasuries (gray, solid) and CLO AAA tranches (navy, solid). FX-funded yields are computed as the dollar yield plus the five-year JPY–USD cross-currency basis swap rate, which captures the cost of obtaining yen-funded dollars using FX swaps. All three instruments are evaluated using the five-year US Treasury yield as the base rate to duration-match the hedge horizon. The CLO AAA yield is the five-year Treasury plus the AAA discount margin at issuance. The dashed horizontal line marks zero: observations below this line indicate that FX-funded returns are negative, implying that Japanese investors pay more to fund their positions than they earn on the underlying dollar asset. The sample is quarterly, 2012Q1–2025Q4.

Figure 4: CLO Market Activity and JPY-USD Cross-Currency Basis

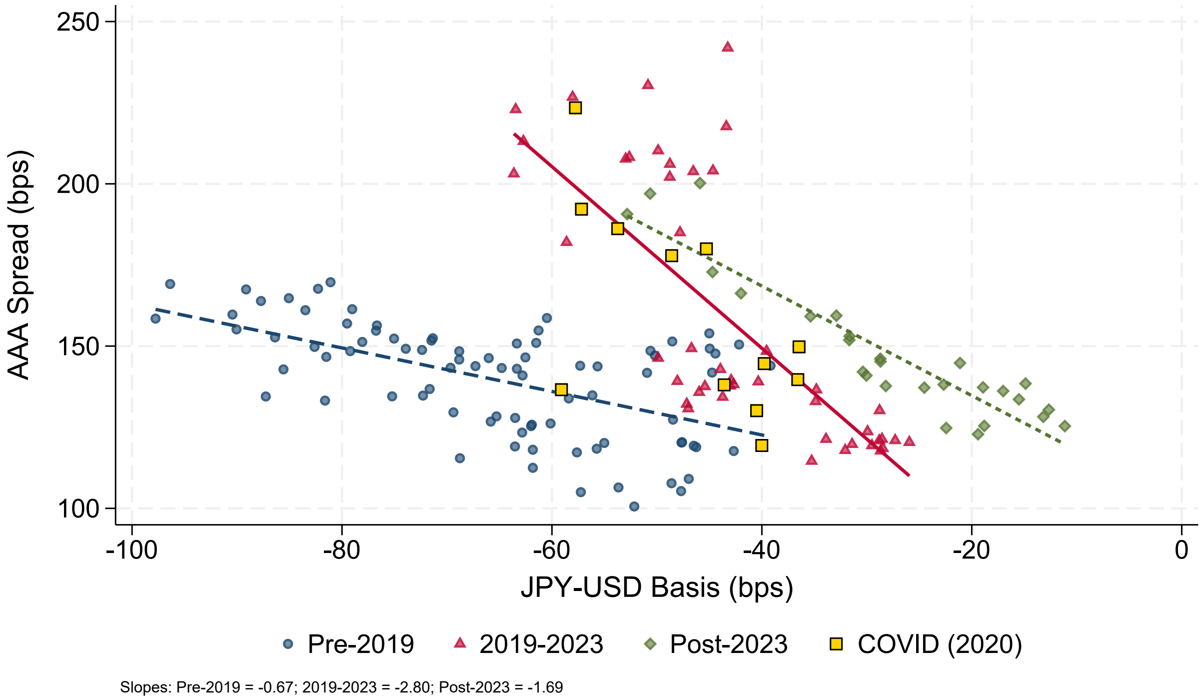


(a) Issuance Volume

(b) AAA Spreads

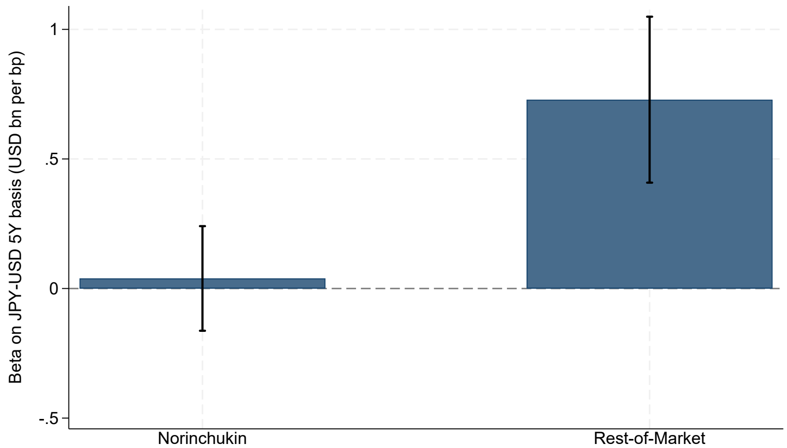
Notes: This figure plots quarterly CLO market outcomes against the 5-year JPY-USD cross-currency basis swap mid price (basis points, right axes) from 2012Q1 to 2025Q4. Panel (a) shows US CLO issuance volume in USD billions (left axis). Panel (b) shows the average US CLO AAA discount margin in basis points (left axis). The cross-currency basis measures the cost for Japanese investors to hedge dollar-denominated CLO exposure back to yen; a more negative basis indicates higher hedging costs.

Figure 5: AAA Spread vs. JPY-USD Basis: Three Regulatory Periods

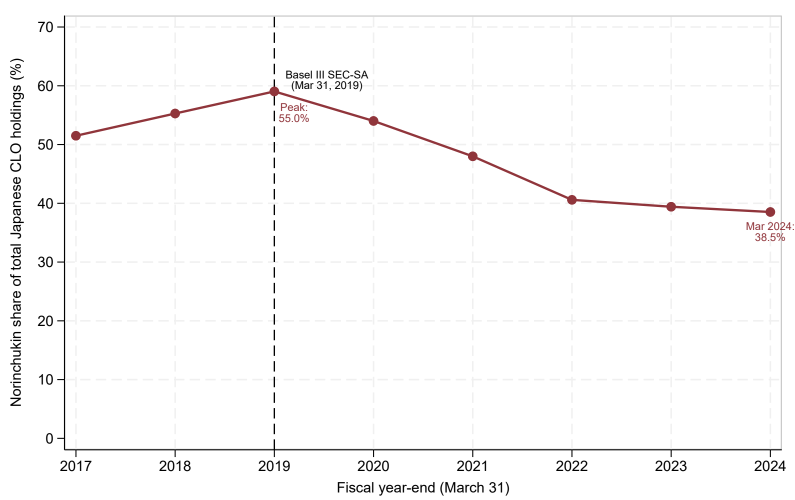


Notes: This figure plots mean AAA tranche discount margins against the JPY–USD five-year cross-currency basis, separately for three regulatory periods: pre-Basel III, January 2012–February 2019 (navy circles); post-Basel III, March 2019–October 2023 (cranberry triangles); and post-BOJ Policy, November 2023–December 2025 (green diamonds). The 2020 observations (COVID) are highlighted as gold squares. The first break corresponds to the March 2019 effective date of the JFSA Basel III risk-retention rule; the second corresponds to the November 2023 Bank of Japan YCC policy adjustment. Observations are collapsed by unique basis–period pairs. OLS regression lines are shown for each subperiod, with slopes reported in the figure note. The sample includes all US CLO AAA tranches issued between 2012 and 2025.

Figure 6: Buyer-Level Basis Elasticity and Norinchukin's CLO Holdings



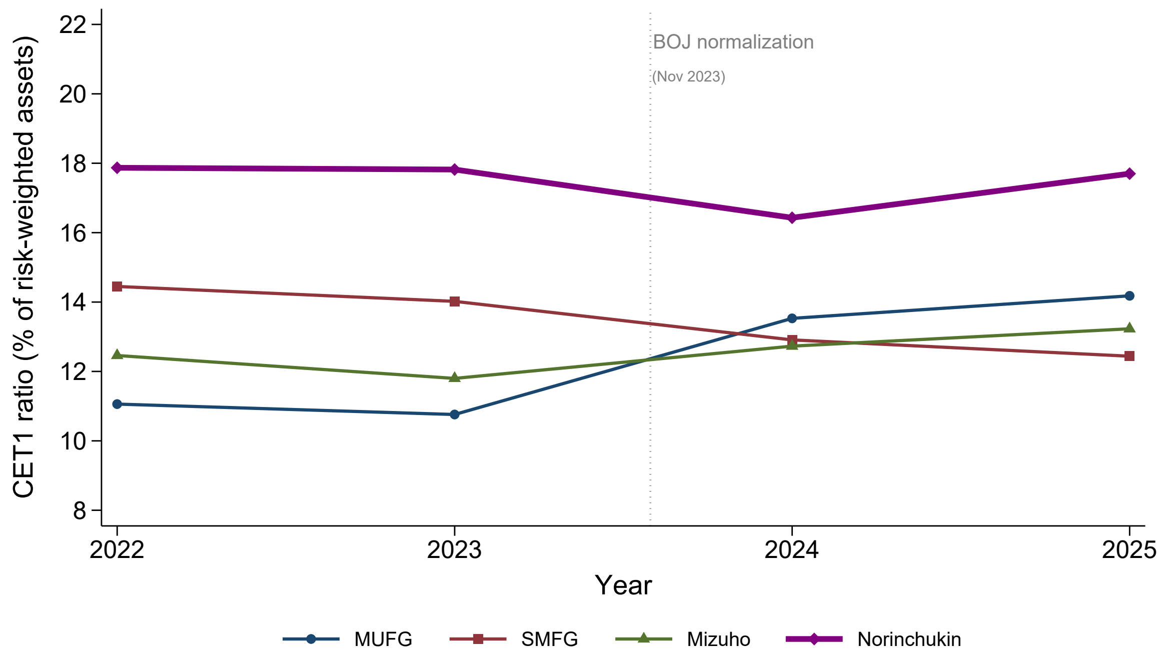
(a) Pre-Basel Buyer-Level Basis-Elasticity



(b) Norinchukin's Share of Japanese CLO Holdings

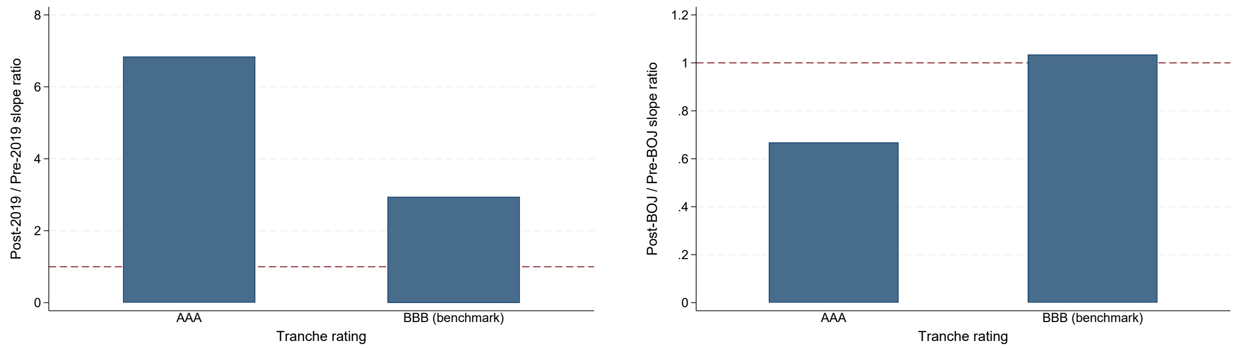
Notes: Panel (a) reports basis-sensitivity coefficients from OLS regressions of semi-annual CLO AAA absorption on the contemporaneous within-window mean JPY-USD 5-year cross-currency basis, estimated separately for Norinchukin and for the residual rest-of-market buyer pool over the pre-Basel III sample 2013–2018 ($n = 12$ semi-annual observations per group). Norinchukin's CLO holdings are taken from Pillar 3 disclosures at fiscal half-year ends (March 31 and September 30), FX-converted to USD billions. Rest-of-market absorption equals total U.S. CLO AAA tranche issuance during each window minus the change in Norinchukin holdings. Bars are point estimates; error bars are 95% confidence intervals from heteroskedasticity-robust standard errors. Panel (b) plots Norinchukin's CLO holdings as a share of total Japanese CLO holdings at fiscal year-ends from 2017 through 2024. Sources: Norinchukin Pillar 3 disclosures (the *Collateralized Loan Obligations* line through FY2017 and the *SEC1 Loans to Corporates* line from FY2018 onward) and aggregate Japanese banks' CLO holdings from the Bank of Japan *Financial System Report*, Chart III-1-17. The dashed vertical line marks the effective date of the Basel III SEC-SA framework for Japanese banks (March 31, 2019).

Figure 7: Japanese Bank CET1 Capital Ratios Around BOJ Normalization



Notes: This figure plots Common Equity Tier 1 (CET1) capital ratios at fiscal year-end (March 31) for the four major Japanese banks active in the U.S. CLO market: MUFG, SMFG, Mizuho, and Norinchukin. CET1 ratios for MUFG, SMFG, and Mizuho are extracted from each bank's SEC Form 20-F filings (Regulatory Capital Requirements sections and supporting narrative); CET1 ratios for Norinchukin are taken from the bank's annual capital adequacy disclosures (nochubank.or.jp/en/ir/results). Cross-validation against overlapping fiscal years (each 20-F reports both current and prior fiscal year-end values) confirms consistency at each transition. Values for fiscal years 2022–2025 for SMFG and Mizuho are reported under the Japanese Basel III transitional framework; later values are under the fully-loaded standard. The dotted line marks the Bank of Japan's policy normalization, with yield-curve-control adjustment in October 2023 and the end of negative interest rates in March 2024.

Figure 8: Basis Pass-Through Amplification by Tranche Rating: Basel III and BOJ Natural Experiments



(a) Basel III (March 2019)

(b) BOJ normalization (November 2023)

Notes: The figure plots the ratio of the post-event to pre-event basis pass-through slope for AAA and BBB tranches. Slopes are estimated separately for each rating-period from the regression $\text{spread}_{i,t} = \beta \cdot \text{basis}_t + \delta_m + \delta_a + \delta_c + \delta_y + \varepsilon_{i,t}$, where δ_m, δ_a, δ_c, and δ_y are manager, arranger, benchmark-rate, and year fixed effects. Panel (a) shows the JFSA Basel III securitization risk-retention rule (effective March 31, 2019), estimated over 2017–2021. Panel (b) shows the Bank of Japan's policy normalization (yield curve control abandonment, effective November 2023), estimated over 2021-2025. The dashed reference line at ratio $= 1$ indicates no change in pass-through. AAA is the tranche where Japanese banks are the marginal investor; BBB tranches are predominantly priced by domestic credit-focused clienteles.

Table 1: JPY-USD Basis and CLO Issuance Activity

	(1)	(2)	(3)
	ln(Volume)	ln(Deals)	AAA Spread
JPY-USD Basis	0.0194***	0.0189***	-0.3402**
	(0.0028)	(0.0024)	(0.1345)
Constant	4.3433***	5.0502***	126.7134***
	(0.1128)	(0.1019)	(8.9924)
N	56	56	56
R^2	0.6163	0.6665	0.0612

Notes: This table reports OLS regressions of quarterly CLO market outcomes on the 5-year JPY-USD cross-currency basis swap mid price. The dependent variables are the log of quarterly CLO issuance volume in USD billions (column 1), the log of the number of CLO deals priced per quarter (column 2), and the average AAA discount margin in basis points (column 3). The sample is 56 quarterly observations, 2012Q1–2025Q4. Newey-West standard errors with four lags in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: JPY-USD Basis and US CLO AAA Spreads

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
JPY-USD Basis	-0.3402**	-0.5478***	-0.9032***	-0.6654***	-0.5113**	-0.6417**	-0.5516**
	(0.1345)	(0.1807)	(0.1980)	(0.1724)	(0.2465)	(0.2516)	(0.2670)
VIX		1.1984*	1.7062***	1.1244**	0.0346	0.0181	-0.1828
		(0.7118)	(0.5661)	(0.5253)	(1.3533)	(1.4426)	(1.4275)
MOVE		0.6742***	0.4859**	0.4922**	0.5403***	0.5685***	0.4221*
		(0.2399)	(0.2107)	(0.2144)	(0.1806)	(0.2022)	(0.2295)
JPY-USD		0.0670	0.0760	0.0899	0.0689	0.1290	0.0153
		(0.2121)	(0.2127)	(0.2487)	(0.2331)	(0.1819)	(0.2738)
Commercial Paper Spread			-82.6641***	-64.9017**	-54.2949*	-31.1587	-57.7742
			(25.7622)	(31.4129)	(28.5711)	(39.6776)	(48.7511)
BAA-AAA Spread				21.0682	25.9816	14.8212	4.2999
				(17.4913)	(17.3547)	(21.0473)	(23.4739)
Term Spread				-0.3207	0.9038	-3.4200	0.8460
				(4.0688)	(4.4385)	(5.2948)	(6.1544)
Bank Volatility					0.5384	0.7895	0.7225
					(0.5970)	(0.7620)	(0.7840)
IP Growth						3.4104	4.0372
						(2.5951)	(2.7856)
Unemployment						5.1650	4.4968
						(4.0198)	(3.6606)
NFCI							59.3814
							(63.6609)
N	56	56	56	56	56	56	56
R^2	0.061	0.583	0.668	0.679	0.685	0.700	0.709

Notes: This table reports OLS regressions of the quarterly average US CLO AAA discount margin (basis points) on the 5-year JPY-USD cross-currency basis swap mid price and progressively richer sets of controls. The regression specification is $s_t = \alpha + \beta\,\text{Basis}_t + \mathbf{X}_t'\gamma + \varepsilon_t$, where $\mathbf{X}_t$ is a vector of macrofinancial controls added progressively across columns. The sample is 56 quarterly observations, 2012Q1–2025Q4. VIX is the CBOE Volatility Index. MOVE is the Merrill Lynch Option Volatility Estimate index for Treasury markets. Commercial Paper Spread is the 3-month AA commercial paper minus 3-month Treasury spread. BAA-AAA Spread is the Moody's corporate bond credit spread. Term Spread is the 10-year minus 2-year Treasury yield. Bank Volatility is the KBW Bank Sector Volatility Index. IP Growth is industrial production growth. Unemployment is the civilian unemployment rate. NFCI is the Chicago Fed National Financial Conditions Index. Newey-West standard errors with four lags in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Cross-Market Placebo: JPY-USD Basis and Spreads

	(1) CLO AAA	(2) Treasury Fixed	(3) Treasury Floating	(4) HY
JPY-USD Basis	-0.5516**	-0.0894	-0.3324	-0.0000
	(0.2670)	(0.1097)	(0.3543)	(0.0001)
VIX	-0.1828	-0.5875	0.7643	-0.0002
	(1.4275)	(0.4244)	(1.4131)	(0.0004)
MOVE	0.4221*	0.1983	0.1230	0.0002*
	(0.2295)	(0.1196)	(0.2182)	(0.0001)
JPY-USD	0.0153	0.3469***	0.1463	0.0000
	(0.2738)	(0.1037)	(0.1817)	(0.0001)
Commercial Paper Spread	-57.7742	61.0255***	-31.7994	-0.0085
	(48.7511)	(20.9019)	(53.1756)	(0.0229)
BAA-AAA Spread	4.2999	25.4356***	-6.6783	-0.0039
	(23.4739)	(7.0752)	(19.5221)	(0.0057)
Term Spread	0.8460	-9.3435***	2.4645	-0.0018
	(6.1544)	(2.4398)	(6.8234)	(0.0027)
Bank Volatility	0.7225	0.1874	-0.7837	-0.0003
	(0.7840)	(0.2621)	(0.8695)	(0.0002)
IP Growth	4.0372	-0.7069	-1.6121	0.0029**
	(2.7856)	(0.8171)	(2.7373)	(0.0012)
Unemployment	4.4968	1.9424	-3.4278	0.0043**
	(3.6606)	(1.3423)	(4.2397)	(0.0018)
NFCI	59.3814	-78.9243***	82.2333*	0.0497***
	(63.6609)	(23.5294)	(47.7602)	(0.0183)
N	56	56	48	56
R^2	0.709	0.928	0.639	0.759

Notes: This table reports OLS regressions of quarterly spreads or yields on the 5-year JPY-USD cross-currency basis swap mid price and the full set of macrofinancial controls. Column (1) reports the CLO AAA discount margin (basis points). Column (2) reports the fixed-rate 2-year Treasury yield (percent). Column (3) reports the Treasury floating-rate note discount margin (basis points). Column (4) reports the high-yield bond spread (percentage points). The sample is 56 quarterly observations, 2012Q1–2025Q4, with the exception of Treasury floating-rate notes, which begin in 2014Q1 (48 observations). VIX is the CBOE Volatility Index. MOVE is the Merrill Lynch Option Volatility Estimate index for Treasury markets. Commercial Paper Spread is the 3-month AA commercial paper minus 3-month Treasury spread. BAA-AAA Spread is the Moody's corporate bond credit spread. Term Spread is the 10-year minus 2-year Treasury yield. Bank Volatility is the KBW Bank Sector Volatility Index. IP Growth is industrial production growth. Unemployment is the civilian unemployment rate. NFCI is the Chicago Fed National Financial Conditions Index. Newey-West standard errors with four lags in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Currency Specificity at the AAA Tranche Level

	(1) Horse Race	(2) PCA
JPY-USD Basis (5Y)	-1.3804***	
	(0.2247)	
EUR-USD Basis (5Y)	0.5397	
	(0.3401)	
GBP-USD Basis (5Y)	-0.6913*	
	(0.3680)	
JPY-specific residual		-0.6753**
		(0.3335)
PC1 (common factor)		-0.6471***
		(0.1140)
Manager FE	✓	✓
Benchmark FE	✓	✓
Arranger FE	✓	✓
Year FE	✓	
N	3,363	3,363
R^2	0.757	0.572

Notes: This table reports tranche-level regressions of CLO AAA discount margins (basis points) on cross-currency basis variables. Column (1) is a horse race with all three 5-year cross-currency bases entered simultaneously. Column (2) reports a principal component decomposition: PC1 captures the common cross-currency funding factor (89.5% of joint variance; loadings JPY = 0.59, EUR = 0.59, GBP = 0.56), and the JPY-specific residual is the JPY basis orthogonalized against PC1. The sample is AAA-rated US CLO tranches priced 2012Q1–2025Q4. Year fixed effects are included in column (1). Both columns include benchmark rate, manager, and arranger fixed effects. Standard errors two-way clustered by manager and month-year in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Rate-Differential Channel and Basis Channel

	AAA Spread (bp)		ln(AAA Tranche Size)	
	(1)	(2)	(3)	(4)
	Basis only	Both	Basis only	Both
JPY-USD Basis (5Y)	-0.9820***	-1.0085***	0.0015***	0.0020***
	(0.0846)	(0.0890)	(0.0005)	(0.0005)
US 5Y − JP 5Y		-2.8982		0.0475***
		(2.3634)		(0.0109)
Manager FE	✓	✓	✓	✓
Benchmark FE	✓	✓	✓	✓
Arranger FE	✓	✓	✓	✓
N	3,363	3,363	3,363	3,363
R^2	0.571	0.574	0.380	0.390

Notes: This table reports OLS regressions of AAA tranche outcomes on the JPY-USD basis, with and without the US-JP rate differential. The estimating equation is $y_{i,t} = \beta_1 \, (\text{US 5Y}_t - \text{JP 5Y}_t) + \beta_2 \, \text{Basis}_t + \delta_m + \delta_c + \delta_a + \varepsilon_{i,t}$, where δ_m, δ_c, and δ_a are manager, benchmark-rate, and arranger fixed effects. Columns (1) and (3) omit the rate-differential term (imposing $\beta_1 = 0$). Columns (1)–(2) use the AAA discount margin (basis points) as the dependent variable; columns (3)–(4) use the log of AAA tranche notional in USD. US 5Y − JP 5Y is the monthly average of the US 5-year Treasury constant maturity yield (FRED `DGS5`) minus the Japanese 5-year government bond yield (Ministry of Finance daily reference rate). JPY-USD Basis (5Y) is the 5-year cross-currency basis swap mid price measured on each tranche's pricing date. The sample is AAA-rated US CLO tranches priced 2012Q1–2025Q4. Standard errors two-way clustered by manager and month-year are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: JFSA Basel III Securitization Rules and Issuance of CLO AAA Tranches

	(1)	(2)	(3)	(4)
		Panel A: Spread		
JPY-USD Basis × Post	-1.4428***	-1.8099***	-1.8103***	-1.8566***
	(0.3286)	(0.6710)	(0.6714)	(0.6676)
JPY-USD Basis	-0.5420***	-0.3570	-0.3569	-0.3029
	(0.1356)	(0.2724)	(0.2725)	(0.2775)
Post	-32.1787**	-80.9547***	-80.9792***	-84.1382***
	(13.7094)	(29.8740)	(29.8918)	(29.5329)
N	1,193	1,193	1,193	1,193
R^2	0.6499	0.7100	0.7100	0.7273
		Panel B: ln***(Tranche Size)***		
JPY-USD Basis × Post	0.0102***	0.0066**	0.0066**	0.0079**
	(0.0020)	(0.0030)	(0.0030)	(0.0032)
JPY-USD Basis	-0.0026*	-0.0012	-0.0012	-0.0022
	(0.0013)	(0.0019)	(0.0019)	(0.0021)
Post	0.2759***	0.2274	0.2272	0.2975*
	(0.0908)	(0.1439)	(0.1440)	(0.1532)
N	1,193	1,193	1,193	1,193
R^2	0.4802	0.4934	0.4934	0.5378
Manager FE	✓	✓	✓	✓
Year FE		✓	✓	✓
Benchmark FE			✓	✓
Arranger FE				✓

Notes: This table reports regressions of AAA tranche characteristics on the JPY-USD basis interacted with a post-2019 indicator. The regression specification is $y_{i,t} = \beta_1(\text{Basis}_t \times \text{Post}_t) + \beta_2 \,\text{Basis}_t + \beta_3 \,\text{Post}_t + \delta_m + \delta_y + \delta_c + \delta_a + \varepsilon_{i,t}$, where $\text{Post}_t = \mathbf{1}[t \geq \text{March 2019}]$ corresponds to the implementation of Basel III risk retention requirements by Japan's Financial Services Agency (effective March 31, 2019). Fixed effects δ_m, δ_y, δ_c, and δ_a are manager, year, benchmark rate, and arranger, added progressively across columns. Panel A reports spreads (discount margin over the benchmark rate in basis points). Panel B reports log AAA tranche size. Column (1) includes manager fixed effects; Column (2) adds year fixed effects; Column (3) adds benchmark rate fixed effects; Column (4) adds arranger fixed effects. The sample is AAA-rated US CLO tranches priced 2017–2021. Standard errors two-way clustered by manager and month-year are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: BOJ Policy Normalization and Issuance of CLO AAA Tranches

	(1)	(2)	(3)	(4)
Panel A: Spread				
JPY-USD Basis × Post	1.4847***	0.7681**	0.7671**	0.7439**
	(0.2545)	(0.3068)	(0.3069)	(0.3012)
JPY-USD Basis	-3.0870***	-2.2197***	-2.2189***	-2.2166***
	(0.2106)	(0.2805)	(0.2806)	(0.2756)
Post	65.5322***	29.8029*	29.7510*	27.9874*
	(8.7960)	(16.2025)	(16.2079)	(15.8083)
N	1,632	1,632	1,632	1,632
R^2	0.7907	0.8312	0.8313	0.8371
Panel B:* ln*(Tranche Size)				
JPY-USD Basis × Post	-0.0041***	-0.0031*	-0.0031*	-0.0033*
	(0.0013)	(0.0017)	(0.0017)	(0.0017)
JPY-USD Basis	0.0050***	0.0053***	0.0053***	0.0054***
	(0.0007)	(0.0010)	(0.0010)	(0.0011)
Post	-0.1545***	-0.1429	-0.1431	-0.1459
	(0.0452)	(0.0927)	(0.0927)	(0.0926)
N	1,632	1,632	1,632	1,632
R^2	0.3958	0.4017	0.4017	0.4254
Manager FE	✓	✓	✓	✓
Year FE		✓	✓	✓
Benchmark FE			✓	✓
Arranger FE				✓

Notes: This table reports difference-in-differences regressions around the Bank of Japan's policy normalization. The regression specification is $y_{i,t} = \beta_1(\text{Basis}_t \times \text{Post}_t) + \beta_2 \text{Basis}_t + \beta_3 \text{Post}_t + \delta_m + \delta_y + \delta_c + \delta_a + \varepsilon_{i,t}$, where $\text{Post}_t = \mathbf{1}[t \geq \text{November 2023}]$. Fixed effects δ_m, δ_y, δ_c, and δ_a are manager, year, benchmark rate, and arranger, added progressively across columns. The BOJ effectively abandoned yield curve control in October 2023 and raised the policy rate for the first time in 17 years in March 2024, increasing the attractiveness of domestic yen assets as an outside option for Japanese banks. Panel A reports spreads (discount margin over the benchmark rate in basis points). Panel B reports log AAA tranche size. Column (1) includes manager fixed effects; Column (2) adds year fixed effects; Column (3) adds benchmark rate fixed effects; Column (4) adds arranger fixed effects. The sample is AAA-rated US CLO tranches priced 2021m1–2025m12. Standard errors two-way clustered by manager and month-year are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Quarter-End Effects on CLO AAA Tranches

Panel A: Spread				
	(1)	(2)	(3)	(4)
JPY-USD Basis × Quarter-End	0.1575**	0.1553**	0.1582**	0.0713**
	(0.0775)	(0.0775)	(0.0707)	(0.0355)
JPY-USD Basis	-1.3323***	-1.3299***	-1.3698***	-0.5926**
	(0.2166)	(0.2167)	(0.2127)	(0.2548)
Quarter-End	5.5939	5.5200	6.1514*	1.6048
	(4.0107)	(4.0080)	(3.5420)	(1.8871)
N	3,501	3,501	3,501	3,501
R^2	0.5747	0.5758	0.5825	0.6802
Panel B: ln(Tranche Size)				
	(1)	(2)	(3)	(4)
JPY-USD Basis × Quarter-End	-0.0010**	-0.0010**	-0.0010**	-0.0009***
	(0.0004)	(0.0004)	(0.0004)	(0.0003)
JPY-USD Basis	0.0049***	0.0049***	0.0051***	0.0052***
	(0.0006)	(0.0006)	(0.0006)	(0.0012)
Quarter-End	-0.0567***	-0.0567***	-0.0596***	-0.0570***
	(0.0203)	(0.0203)	(0.0212)	(0.0164)
N	3,501	3,501	3,501	3,501
R^2	0.0554	0.0555	0.0567	0.0692
Year FE	✓	✓	✓	
Benchmark FE		✓	✓	✓
Quarter FE			✓	
Year-Quarter FE				✓

Notes: This table reports tranche-level regressions of CLO AAA outcomes on the 5-year JPY-USD cross-currency basis and a quarter-end indicator. The regression specification is $y_{i,t} = \beta_1 \text{ Basis}_t + \beta_2 \text{ QE}_t + \beta_3 (\text{Basis}_t \times \text{QE}_t) + \delta_c + \delta_y + \delta_q + \varepsilon_{i,t}$, where $\text{QE}_t = \mathbf{1}[t \in \{\text{March, June, September, December}\}]$ indicates a calendar quarter-end month, and δ_c, δ_y, and δ_q are benchmark-rate, year, and quarter fixed effects. Quarter-end equals one for tranches priced in March, June, September, and December. Panel A reports spreads (discount margin over the benchmark rate in basis points). Panel B reports log AAA tranche size. Column (1) includes year fixed effects. Column (2) adds benchmark fixed effects. Column (3) adds quarter fixed effects. Column (4) replaces year and quarter fixed effects with year-quarter fixed effects, which absorb all quarterly-level variation in the basis; identification in this specification comes from within-quarter differences between quarter-end and non-quarter-end months. The sample is AAA-rated US CLO tranches priced 2012Q1–2025Q4. Standard errors two-way clustered by manager and month-year in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Online Appendix for:

"When Funding Markets Move Credit Markets: Foreign Investors and U.S. CLOs"

Appendix A Norinchukin Bank: The CLO Whale

The concentration of Japanese CLO investment is extreme. Norinchukin Bank, the central cooperative bank for Japan's agricultural, forestry, and fishery cooperative system, alone accounted for approximately half of all Japanese CLO holdings at its peak.[22] Other significant Japanese CLO holders include the megabanks (MUFG, SMFG, and Mizuho) and several regional banks, but none approach Norinchukin's scale. This concentration means that the portfolio decisions of a single institution have outsized effects on CLO AAA demand and, through the hedging channel we model, on equilibrium pricing.

Norinchukin's business model differs fundamentally from that of a conventional commercial bank. With a relatively small lending portfolio, its ¥56 trillion (≈ $357 billion) investment portfolio constitutes the bulk of its assets. The bank collects yen deposits from Japan's approximately 600 agricultural, forestry, and fishery cooperatives and deploys them into global securities, historically emphasizing US and European government bonds and CLO AAA tranches. This structure makes Norinchukin uniquely sensitive to the interaction between global interest rates and FX hedging costs: its entire business model rests on earning a positive hedged spread on foreign-currency assets funded with yen liabilities.

The bank's recent experience illustrates the mechanisms central to our paper. When the Federal Reserve's aggressive rate hikes in 2022–2023 pushed short-term dollar rates above the yields on Norinchukin's legacy bond holdings, the bank's foreign-currency funding costs surged beyond what it earned on those securities. By March 2024, unrealized losses on its bond portfolio had reached ¥2.2 trillion (≈ $14.5 billion). In June 2024, Norinchukin announced plans to sell approximately ¥10 trillion (≈ $63 billion) of US and European sovereign bonds, nearly a sixth of its global portfolio, to stem the losses (Uranaka and Scanlan, 2024). The bank ultimately posted a net loss exceeding ¥1.7 trillion (≈ $11.2 billion) for fiscal year 2024, the largest in its century-long history.[23]

[22] Norinchukin's CLO holdings reached ¥8.0 trillion (approximately $74 billion) in June 2019, according to the bank's official financial results. See Financial Summary for Fiscal Year 2020, page 11. At this point, total Japanese bank CLO holdings stood at approximately ¥14.5 trillion, implying a Norinchukin share of roughly 55%.

[23] The bank subsequently raised capital from its member cooperatives (see Norinchukin Capital Enhancement announcement, March 31, 2025), echoing a similar recapitalization during the 2008–2009 financial crisis when the bank incurred significant losses on asset-backed securities.

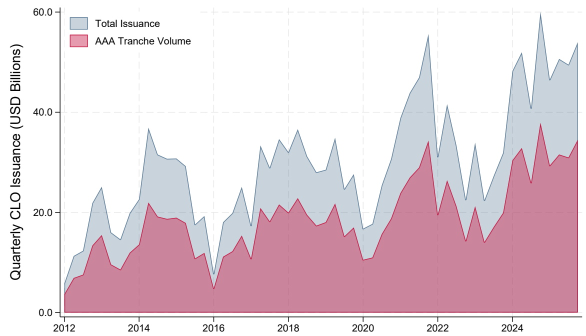
Importantly for our analysis, Norinchukin's reallocation away from sovereign bonds flowed *toward* CLOs, not away from them. The bank's CLO holdings, which had dipped to ¥6.5 trillion ($\approx$ \$45 billion) in September 2024 as redemptions ran off, rebounded sharply to ¥8.2 trillion ($\approx$ \$53 billion) by December 2024 and ¥9.7 trillion ($\approx$ \$65 billion) by September 2025 – a new all-time high. The bank's revised strategy would reduce sovereign interest rate risk and diversify into assets involving corporate and individual credit risks, explicitly including CLOs as a target asset class.[24] Consistent with this strategy, Norinchukin's bond holdings (predominantly sovereign) declined, while credit and other investments grew from 2024 through 2025 (see Norinchukin Bank, FY2025 First Half Financial Summary).

This episode demonstrates two key points. First, CLO AAA tranches occupy a distinct position in Japanese banks' asset allocation: they offer a hedged yield premium unavailable in sovereign bonds, shown in Figure 3, making them a preferred destination when banks reallocate within their dollar portfolios. Second, the scale of Norinchukin's portfolio adjustments is large enough to move market equilibrium; a single institution's decision to increase CLO holdings by ¥3 trillion over three quarters represents a meaningful demand shock in a market with approximately \$500 billion in AAA outstanding.

[24] Deutsche Bank estimated that if 25% of the ¥10 trillion earmarked for reallocation were channeled toward CLOs, it would represent approximately \$16 billion of net new demand for AAA CLO paper (Kollmorgen and Kramer, 2024).

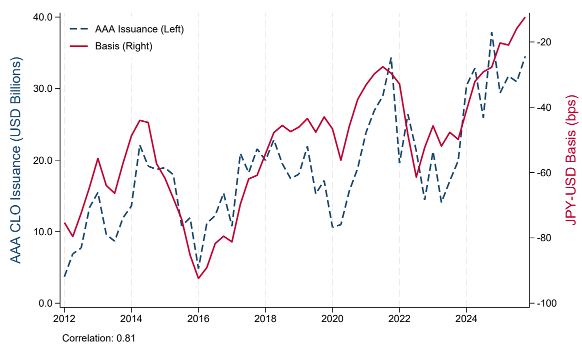
Appendix B Additional Figures

Figure B.1: AAA CLO Issuance and the Cross-Currency Basis

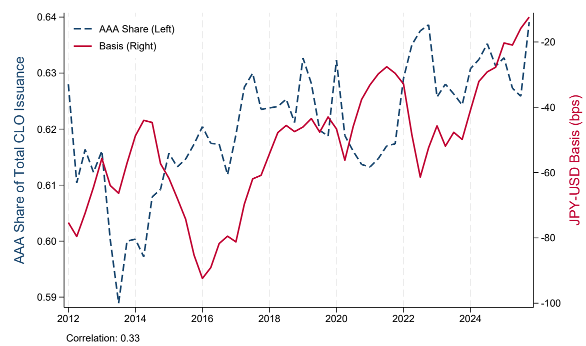


(a) Total vs. AAA Issuance

(b) AAA Share of Total Issuance



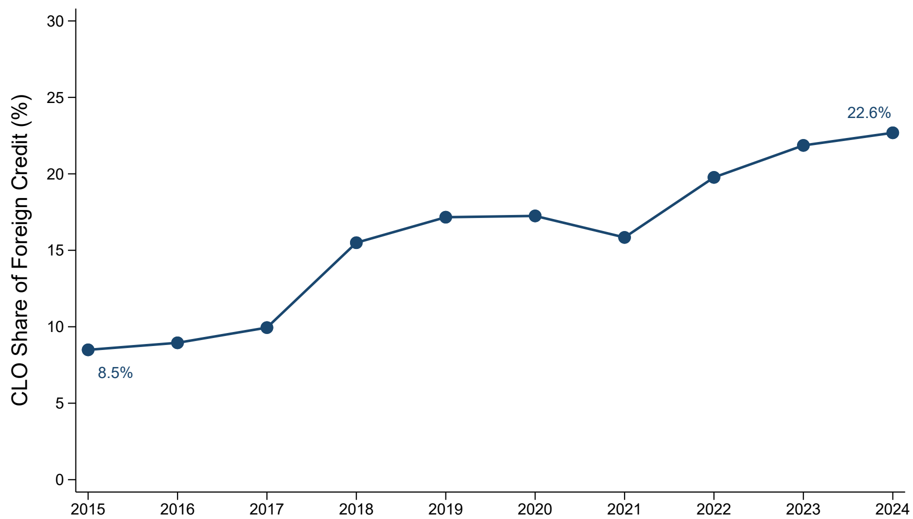
(c) AAA Issuance and JPY-USD Basis



(d) AAA Share and JPY-USD Basis

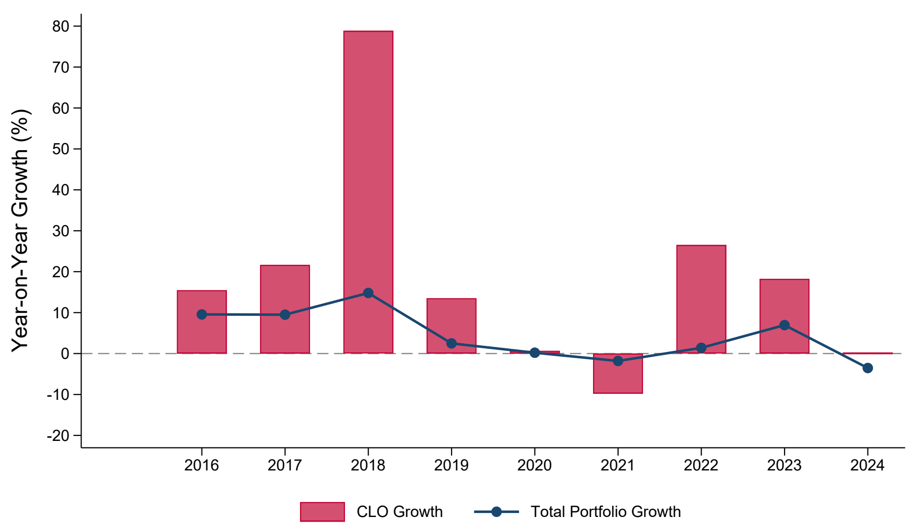
Notes: Panel (a) plots quarterly total CLO issuance and AAA tranche volume (USD millions), 2012Q1–2025Q4. Panel (b) plots the AAA share of total CLO issuance by volume. Panels (c) and (d) overlay the JPY-USD 5-year cross-currency basis (right axis, bps; more negative = higher hedging cost). AAA tranche volume is the sum of all AAA-rated tranche sizes within each deal, aggregated to the quarter.

Figure B.2: CLO Share of Japanese Banks' Overseas Credit Portfolio



Notes: This figure plots CLOs as a share of Japanese banks' total overseas credit holdings, using data from the Bank of Japan Financial System Report.

Figure B.3: Year-on-Year Growth in Japanese Banks' CLO Holdings



Notes: This figure plots year-on-year growth rates for Japanese banks' CLO holdings (solid line) and total overseas credit portfolio (dashed line), using data from the Bank of Japan Financial System Report.

Appendix C Additional Tables

Table C.1: JPY-USD Basis and CLO Issuance Volume

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
JPY-USD Basis	0.0194***	0.0152***	0.0183***	0.0120***	0.0111***	0.0105**	0.0112*
	(0.0028)	(0.0022)	(0.0029)	(0.0035)	(0.0039)	(0.0048)	(0.0058)
VIX		-0.0164**	-0.0208***	-0.0053	0.0011	0.0003	-0.0014
		(0.0071)	(0.0050)	(0.0076)	(0.0178)	(0.0189)	(0.0191)
MOVE		-0.0044	-0.0028	-0.0029	-0.0032	-0.0045	-0.0058*
		(0.0028)	(0.0028)	(0.0025)	(0.0024)	(0.0028)	(0.0029)
JPY-USD FX		0.0106***	0.0105***	0.0100***	0.0102***	0.0081**	0.0072*
		(0.0039)	(0.0035)	(0.0034)	(0.0035)	(0.0034)	(0.0039)
Commercial Paper Stress			0.7241**	0.2566	0.1942	-0.4794	-0.7036
			(0.3590)	(0.3620)	(0.3473)	(0.6277)	(0.6132)
BAA-AAA Spread				-0.5652**	-0.5940**	-0.5180**	-0.6066***
				(0.2245)	(0.2488)	(0.2552)	(0.1704)
Term Spread				0.0058	-0.0014	0.0701	0.1061
				(0.0456)	(0.0486)	(0.0612)	(0.0895)
Bank Volatility					-0.0032	0.0014	0.0009
					(0.0065)	(0.0102)	(0.0106)
IP Growth						-0.0191	-0.0139
						(0.0280)	(0.0245)
Unemployment						-0.0812	-0.0869*
						(0.0509)	(0.0494)
NFCI							0.5003
							(0.8633)
N	56	56	56	56	56	56	56
R^2	0.616	0.744	0.764	0.787	0.787	0.797	0.799

Notes: This table reports OLS regressions of the log of quarterly CLO issuance volume (USD billions) on the 5-year JPY-USD cross-currency basis swap mid price and progressively richer sets of controls. The estimating equation is $\ln(\text{Volume}_t) = \alpha + \beta\,\text{Basis}_t + \mathbf{X}_t'\gamma + \varepsilon_t$, where $\mathbf{X}_t$ is a vector of macrofinancial controls defined as in Table 2. The sample is 56 quarterly observations, 2012Q1–2025Q4. Newey-West standard errors with four lags in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C.2: JPY-USD Basis and AAA Spread by Basis Tenor

AAA Discount Margin (bp)	(1) 3M	(2) 6M	(3) 1Y
JPY-USD Basis	-21.9067***	-35.0399***	-43.0130***
	(7.5396)	(7.9293)	(9.0529)
Manager FE	✓	✓	✓
Benchmark FE	✓	✓	✓
Arranger FE	✓	✓	✓
N	3,144	3,144	3,144
R^2	0.435	0.453	0.462

Notes: This table reports OLS regressions of the AAA discount margin (in basis points) on the JPY-USD cross-currency basis at three short tenors. The sample is AAA-rated U.S. CLO tranches priced 2012–2025, with a common sample of 3,144 tranches across columns. The basis series at each tenor is the constructed FX-implied (covered-interest-parity) "spot-log" basis built from spot FX, forward FX, and OIS rates. All specifications include benchmark-rate, manager, and arranger fixed effects. Standard errors two-way clustered by manager and month-year are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.