PGIM FIXED INCOME Perspectives May 2017

The Compelling Case for Global Senior CLOs

Pricing inefficiencies, low betas to underlying assets, and loss and downgrade remoteness are among the defining attributes.

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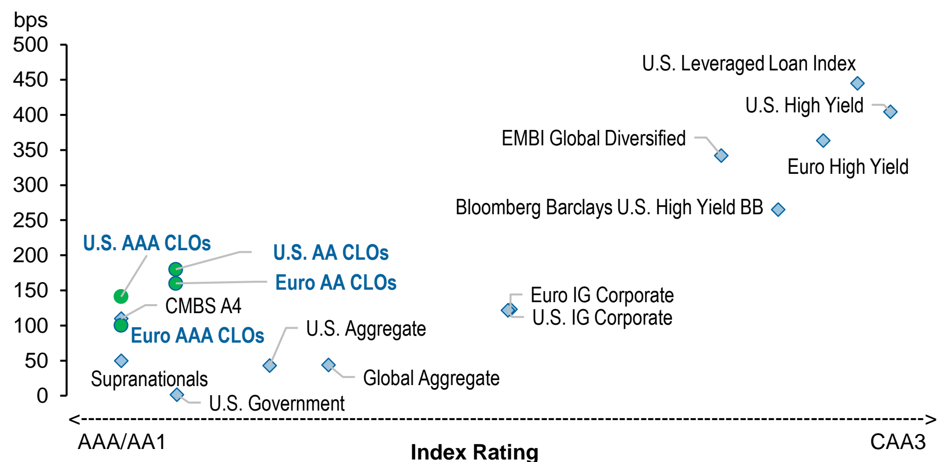
The case for global AAA and AA CLOs is simple. Fundamentally, structured products are an alternative means of financing assets. Investors at the top of the capital structure provide financing, investors in the equity receive financing, and investors in the mezzanine tranches exist in the occasionally perilous state in between.

As angst rises about asset reflation and potential bubbles in the wake of unprecedented central bank accommodation and a historically long economic expansion, AAA and AA[1] CLO tranches offer investors a compelling safe haven—the ability to generate comparatively high risk-adjusted returns by financing someone else's speculative leveraged loan investments, rather than leveraging such credit exposure themselves.

CLOs vs Other Risk Assets

When the spreads on a variety of fixed income investments are plotted relative to their external credit rating, as depicted in Chart 1, it is clear that European and U.S. CLOs offer not only some of the widest spreads of any highly-rated investments, but also compelling value relative to assets of lower credit quality.

CHART 1
NOMINAL SPREAD VS. RATING
As of December 31, 2016



Source: Barclays, J.P. Morgan, Bloomberg

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[1] *For readability purposes, we refer to AAA and AA tranches as "senior" investments, notwithstanding the seniority of AAAs to AAs.*

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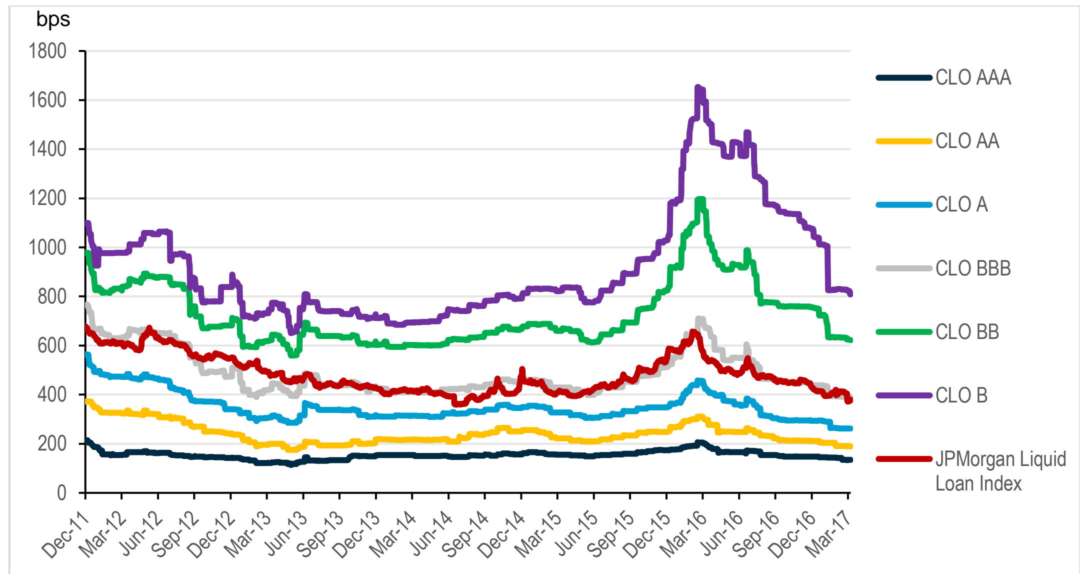
The Benefits of Going Global

In comparison to the U.S., the European CLO market is smaller and currently offers less spread at the senior part of the capital structure, yet there are important benefits to looking at CLOs globally. Despite efforts at regulatory harmonization, different regulatory regimes in the U.S. and Europe create inefficiencies and mispricings between the two markets. Divergent central bank policies are another source of profitable misalignments between European and U.S. assets. The jurisdictional crossover buyer base, while growing, remains small, allowing cross-border, relative-value gaps to persist long enough to take advantage of them. It is also worth noting the tangible differences between U.S. and European CLOs, including the use of high yield bonds in European CLOs and the related issuance of fixed-rate liabilities. Lastly, currency-basis fluctuations, coupled with the prevalence of non-currency hedging investors, also contribute to pricing inefficiencies. In short, the ability to rotate amongst European and U.S. CLOs provides opportunities to capitalize on pricing inefficiencies between the two markets.

Relative Value Within the CLO Capital Structure

Chart 2 shows the nominal spreads for different tranches in the CLO capital structure. While most tranches are trading near their post-financial crisis tights, senior CLOs have exhibited far less spread volatility than their mezzanine counterparts. Notably, the volatility in CLO spreads is not simply a question of the financial crisis and its immediate aftermath. Rather, mezzanine spreads have shown repeated sensitivity to global bouts of risk-on / risk-off sentiment, most recently during the 2015/2016 energy bust. While senior CLOs are not immune to volatility, their historical spread stability is further testament to an attractive, risk-adjusted profile.

CHART 2
THE STABILITY OF POST-CRISIS U.S. SENIOR CLO TRANCHE SPREADS RELATIVE TO OTHER TRANCHES AND LEVERAGED LOANS



Source: PGIM Fixed Income, J.P. Morgan CLOEI Index, as of March 10, 2017

Although lower-rated CLO tranches have generally outperformed higher-rated tranches in the recent years of a largely benign credit environment, the heightened volatility in mezzanine tranches has resulted in notably lower Sharpe ratios over this timeframe. Indeed, as observed in Table 1, BBB CLOs exhibited a Sharpe ratio of just 1.27

compared to 1.87 for AAA CLOs and 1.65 for AA CLOs from January 2012 to February 2017, according to J.P. Morgan.[2]

For investors concerned about drawdown risk, Table 1 highlights another benefit of senior CLOs relative to mezzanine tranches, as the maximum drawdown on AAA and AA CLOs was just 61 bps and 247 bps, respectively, over any three-month period, while BBB CLOs suffered a maximum drawdown of almost 10%.

A final point worth highlighting from Table 1 is the beta analysis in the last column. As previously mentioned, structured products are fundamentally about financing the underlying assets in the trust. Intuitively, the further down the capital structure one invests, the more exposure one gains to the underlying assets. The beta column in Table 1 shows the return sensitivity of each sub-index relative to the return of the Credit Suisse Leveraged Loan Index. For example, the beta of 0.29 for the AAA index means that empirically, AAA returns declined 29 bps for a 100 bps decline in the Credit Suisse Leveraged Loan Index. In contrast, the structurally-leveraged B-rated index exhibited a 468 bps decline for a 100 bps decline in the Index. Somewhat less intuitive is that BBB-rated CLOs register more than twice the return sensitivity to leveraged loans (a beta of 2.11) despite carrying a higher credit rating than the leveraged loan index itself. This underscores an important consideration for CLO investors—that mezzanine CLO tranches frequently represent an inefficient means of expressing a leveraged view on the underlying collateral. It is generally, but not always, our view that investors seeking leveraged loan exposure are better served by purchasing leveraged loans directly, rather than subordinated CLO tranches. Investors looking to finance purchases of loans should consider using beta analysis to assess the sensitivity of their potential investment to fluctuations in the value of the collateral being financed.

TABLE 1
POST-CRISIS JPM CLO (CLOIE) INDEX AND CREDIT SUISSE LEVERAGED LOAN INDEX DATA
From January 2012 through February 2017

	Annualized Total Return	Annualized St Dev	Sharpe Ratio	Max 3m Drawdown	Empirical Beta
AAA	2.04%	1.09%	1.87	-0.61%	0.29
AA	3.67%	2.22%	1.65	-2.47%	0.67
A	6.08%	3.95%	1.54	-4.72%	1.21
BBB	9.05%	7.13%	1.27	-9.96%	2.11
BB	11.77%	12.37%	0.95	-18.29%	3.84
B	15.13%	16.38%	0.92	-27.75%	4.68
CS LL Index	5.41%	2.47%	2.18	-2.54%	1.00

Shown for illustrative purposes only. Source of index data: JP Morgan, Credit Suisse. The figures shown above are calculated using monthly data from January 2012 through February 2017. The JPM CLO (CLOIE) index starts in Jan 2012.

The empirical results in Table 1 are further substantiated by analyzing CLOs in a risk-neutral framework. Our risk-neutral model is a stochastic simulation of the underlying portfolio's enterprise valuations[3], with losses calibrated to achieve a zero-expected excess return on the portfolio. Using a LIBOR discount rate, we then calculate risk-neutral intrinsic values for each tranche. As illustrated in Table 2, a risk-neutral analysis of a recently issued CLO shows that the AAA and AA tranches have the greatest intrinsic value relative to market prices—3.04 and 3.13 points cheap, respectively—while the BBB tranche appears 10.19 points rich to intrinsic value. In this example, the

[2] *Based on data from January 2012 to February 2017, according to J.P. Morgan.*
[3] *To be clear, we simulate company valuations rather than the valuation of the leveraged loan itself.*

theoretical market-implied betas are roughly similar to what we empirically observed in Table 1: The market-implied beta for AAAs is almost zero, while the market-implied beta for BBBs is 3 times the collateral.

TABLE 2: SAMPLE OF A 2017 VINTAGE U.S. CLO

Tranche	Balance	Par Subord -ination	External Ratings (Moody's/ Fitch)	Nominal Spread	Base Case Stochastic Model: Risk-Neutral Intrinsic Value	Market Price	Risk-Neutral Cheapness / (Richness)	Market Implied Beta
A	384,000,000	36.0%	Aaa/AAA	3mL + 1.26%	103.04	100.00	3.04	(0.10)
B	66,000,000	25.0%	Aa2/-	3mL + 1.65%	103.13	100.00	3.13	0.20
C	37,800,000	18.7%	A2/-	3mL + 2.30%	97.36	100.00	(2.64)	1.55
D	37,800,000	12.4%	Baa3/-	3mL + 3.30%	89.81	100.00	(10.19)	3.02
E	26,400,000	8.0%	Ba3/-	3mL + 5.70%	86.21	98.00	(11.79)	4.90
EQUITY	59,370,000		NR		60.65	85.00	(24.35)	4.25
COLLAT	600,000,000		Avg B2		99.86	99.86	-	1.00

Source: PGIM Fixed Income

A final point worth highlighting in the context of risk-neutral modeling relates to the sensitivity of tranche valuations to the correlation asssumption between credits in the underlying portfolio. In many respects, the post-crisis era has been an exceptional environment for CLO mezzanine and equity investors due to declining volatility, attractive underlying asset valuations, and only localized episodes of distress (e.g. energy in 2016). In such an environment, investors in CLO mezzanine tranches may be understandably lulled into a false sense of security about the robustness of these tranches. However, as seen in Table 3 below, mezzanine tranches are quite sensitive to correlations between underlying portfolio assets. Our base case, risk-neutral valuation assumes a 50% pairwise correlation assumption, but if that correlation increases to 75%, the risk-neutral prices for the cuspier A and BBB-tranches decline by 6% and 5%, respectively. In contrast, the price of the AAA tranche is virtually unaffected by changes in the correlation assumption, while the AA tranche valuation declines by just 3%. The real world implication of this theoretical construct is that investors concerned about a broad-based bear market for leveraged credit—analagous to correlations increasing—should take solace in the comparative robustness of senior tranche valuations in high-correlation scenarios.

TABLE 3:
SAMPLE OF A 2017 VINTAGE U.S. CLO

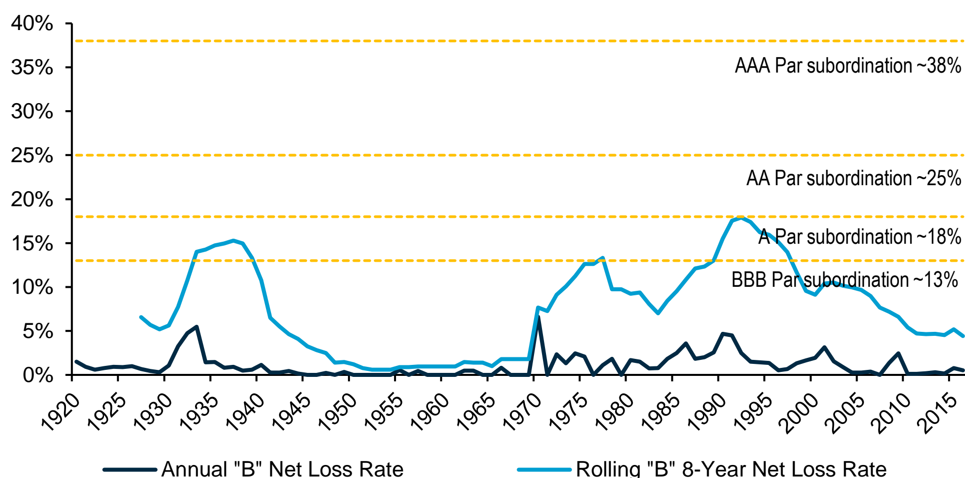
Tranche	Balance	Par Subord -ination	External Ratings (Moody's/ Fitch)	Nominal Spread	Market Price	Risk-Neutral Stochastic Results Under Varying Correlation Assumptions		
						0.25	0.50	0.75
A	384,000,000	36.0%	Aaa/AAA	3mL + 1.26%	100.00	102.94	103.04	103.08
B	66,000,000	25.0%	Aa2/-	3mL + 1.65%	100.00	104.56	103.13	100.13
C	37,800,000	18.7%	A2/-	3mL + 2.30%	100.00	102.50	97.36	91.63
D	37,800,000	12.4%	Baa3/-	3mL + 3.30%	100.00	95.75	89.81	85.35
E	26,400,000	8.0%	Ba3/-	3mL + 5.70%	98.00	91.04	86.21	83.73
EQUITY	59,370,000		NR		85.00	51.58	60.65	70.50

Source: PGIM Fixed Income

Loss and Downgrade Remote

One reason AAA and AA CLOs continue to trade at what we consider to be bewilderingly wide spreads is the tendency of some investors to conflate CLOs with (ABS) CDOs. This is unfortunate (for those investors), because unlike ABS CDOs, CLOs proved resilient during the financial crisis. In fact, the history of the financial crisis supports our assertion that senior CLOs are extremely loss remote assets. Chart 3 shows inferred annualized loss rates on single-B rated enterprises from 1920 to today. We infer these loss rates by taking yearly historical default rates and applying a constant, yet historically appropriate, bank loan recovery rate of 66% (dark blue line). The light blue line shows the resulting historical rolling eight-year cumulative-loss rates. The horizontal lines show typical par subordination levels for AAAs, AAs, As and BBBs, respectively. As this chart illustrates, on an aggregate basis, the worst cumulative inferred eight-year loss rate in B-rated corporates would only have approached the typical 18% par attachment point on A-rated CLOs just once in nearly a century. Furthermore, the eight-year loss rate does not come close to threatening the AAA or even AA attachment point in this analysis even before factoring in CLO structural nuances, such as excess spread and performance triggers.

CHART 3:
EIGHT YEAR COHORT CORP "B" NET LOSSES VS. CLO ATTACHMENTS ASSUMES A BANK LOAN RECOVERY OF 66%



Shown for illustrative purposes only. Source: PGIM Fixed Income

However, as many investors are aware, catastrophic mark-to-market losses generally precede any actual incidences of loss, with rating agency downgrades being a frequent catalyst due to forced selling. Tables 4 and 5 show 10-year ratings transition rates for AAA and AA CLOs and corporates, respectively. For CLO tranches originally rated AAA, the downgrade percentage was 2.54% and the downgrade percentage to non-investment grade was 0.12%. In comparison, AAA-rated corporates experienced a historical downgrade rate of 38%, with 0.75% downgraded below IG. The difference between corporates and CLOs is even starker at the AA ratings level. We believe the historically low ratings volatility of senior CLO tranches underscores their value as a core holding in multi-sector fixed income portfolios.

TABLE 4:
GLOBAL CLO RATING TRANSITION MATRIX*
10-Years Long Average Rating Migration Rates: January 1, 1993- June 30, 2016

Original Rating	Rating Transition To:								Downgrade to non-IG	Downgrade
	Aaa	Aa	A	Baa	Ba	B	Caa-C	Impairment**		
Aaa	97.47%	1.96%	0.46%	0.00%	0.00%	0.12%	0.00%	0.00%	0.12%	2.54%
Aa	72.85%	22.62%	2.04%	1.81%	0.68%	0.00%	0.00%	0.00%	0.68%	4.53%

*Sources: *Moody's "Structured Finance - Global: Structured Finance Rating Transitions: 1993 - 2016H1," November 1, 2016.*
***Moody's "Ratings Symbols and Definitions," December, 2106, Impairment includes all events that meet definition of default.*

TABLE 5:
CORPORATE RATING MIGRATION: U.S. AND EUROPE*
10-Years Long Average Rating Migration Rates: January 1, 1993- June 30, 2016

Original Rating	Rating Transition To:								Downgrade to non-IG	Downgrade
	Aaa	Aa	A	Baa	Ba	B	Caa-C	Def		
Aaa	61.93%	21.61%	11.72%	3.99%	0.75%	0.00%	0.00%	0.00%	0.75%	38.07%
Aa	4.88%	38.82%	37.45%	13.69%	3.31%	0.88%	0.10%	0.87%	5.16%	56.30%

*Sources: *Moody's Default and Rating Analytics, Historical Rating Transitions, withdrawals excluded.*
Note: The Global CLO Rating Transition and Corporate Rating Migration tables were not derived from the same source, and while we believe the information is comparable, it is possible that the underlying methodologies may not be identical.

Appealing Liquidity and Transparency Characteristics

Other benefits of CLO investments can be more difficult to quantify, but are nonetheless meaningful. In terms of both market depth and bid/offer spreads, liquidity in senior CLOs is generally comparable, if not superior, to liquidity in investment grade corporates and shorter-duration high yield. In the U.S. market, the bid/offer for senior CLOs is generally in the range of 1-5 bps in nominal spread, and it is not uncommon for daily secondary trading volumes to exceed $500 million. In contrast, liquidity in mezzanine CLOs is more challenging than in senior tranches with prices prone to gaps in both bullish and bearish markets, as evidenced in Chart 2 shown previously.

Relative to other structured products, CLOs offer the added benefit of greater transparency with respect to the underlying collateral. In fact, CLOs are somewhat unique amongst structured products in terms of having an underlying collateral pool with independent ratings and market prices derived from daily trading at the asset level. While loan-level data are emerging in certain structured products due to regulatory mandates, consumer privacy and securities laws still limit the extent of information available to investors for other collateral types. CLOs offer the

benefit of full transparency into the collateral manager's investment activities and the underlying trust assets, with monthly and quarterly trustee reports providing thorough summaries of structural calculations (such as CLO indenture covenants and the results of percentage limitations tests), in addition to trading activity, prices, prepayments, and other portfolio characteristics.

AAA Tranches Represent the Controlling Class in the Capital Structure

A final, but important consideration for CLO investors pertains to structural governance. Unlike other securitized assets, senior investors in CLOs are frequently able to negotiate favorable contractual rights providing AAA investors a voice, and in some cases a veto, on amendments and other actions that could impact AAA cashflows. This represents a meaningful improvement over the governance deficiencies of other structured products. In RMBS, for example, passive third-party service providers, such as trustees and servicers, wield significant influence over deal performance and frequently act contrary to bondholder interests. In CMBS, the controlling class is generally the first loss tranche, whose bondholders have also historically acted against the interests of senior bond holders. Lastly, U.S. CLO managers are registered investment advisers under the Investment Advisers Act of 1940 with a fiduciary duty to act in the best interests of a CLO issuer, affording CLO investors a greater array of legal protections.[4]

Conclusion

- AAA and AA CLOs offer attractive relative and absolute value for global fixed income investors searching for yield-enhancing investments and attractive risk-adjusted returns.
- Investors can benefit by looking at potential CLO opportunities in both Europe and the U.S.
- AAA and AA CLOs typically offer comparable spreads to investment grade corporates with less historical credit migration risk.
- Relative to mezzanine CLO investments, senior CLO tranches exhibit comparatively little sensitivity to the performance of the underlying collateral, resulting in a better risk/reward profile.
- Historical analysis of losses and credit migration support our view that senior CLOs are both loss and downgrade remote.
- Intangible considerations, including liquidity, transparency, and governance provide further support for the asset class.

[4] *European CLO managers are subject to contractual and local market regulatory oversight obligations.*

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Source(s) of data (unless otherwise noted): PGIM Fixed Income as of May 2017.

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