



COMMONWEALTH OF PENNSYLVANIA
PUBLIC SCHOOL EMPLOYEES' RETIREMENT SYSTEM

High Yield / Private Credit Asset Class Review

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March 8, 2018

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Executive Summary

As of 9/30/17

Performance:

- PSERS High Yield / Private Credit Portfolio has an inception (2007) to date net IRR¹ and MoC² of **8.8%** and **1.3x**, respectively
- Portfolio (based on dollar-weighted IRR) outperformed the policy benchmark (Barclays US HY Index)³ over the one-year, three-year, five-year, and since-inception periods

Asset Allocation:

- Current allocation to High Yield is **8.6%** as of September 30, 2017, relative to an 8.0% target
 - HY allocation target increased to 10.0% (up from 8.0%) in October, 2017

Strategy:

- Beginning in 2007, PSERS began transitioning its public high yield allocation to include various private credit structures
 - Higher potential returns / Access to markets overlooked by traditional fixed income managers; idiosyncratic risk
 - Better investor rights and protection / Stronger alignment of interests between borrowers and lenders
- Today, PSERS' high yield allocation is entirely allocated through private fund structures
- Opportunistically target complementary strategies/sectors across private credit spectrum with potential for portfolio to earn net double-digit returns

1) IRR: Internal Rate of Return represents the rate of return on an investment, calculated by using a discount rate that equates the present value of future net cash flows to the cost of the original investment.

2) MoC: Multiple of (Invested) Capital is the ratio of distributed and undistributed portfolio value to original invested capital. MoC is also known as Investment Multiple (Multiple), or Total Value to Paid In (TVPI).

3) The policy benchmark (Barclays Corporate High Yield), sourced from AON's Q3'17 Total Fund Report, is a time weighted benchmark and is the official mandated benchmark for the High Yield portfolio.

Executive Summary (cont'd)

Portfolio Highlights:

- Strong appreciation across the portfolio for the LTM 9/30/17 time period with >80% of investments generating net value gains; total net value change of **\$445.3M** for the portfolio
- Active 2017 with \$925 million in new commitments (high-conviction re-up pipeline / market opportunity)

2017 Commitment Summary (\$M)	
Investment	Committed
Apollo European Principal Finance Fund III	\$ 200
Avenue Energy Opportunities Fund II	100
Bain Capital Special Situations Asia (Strategy Inclusion)	75
Cerberus PSERS Levered Loan Opportunities Fund (Increase)	75
Galton Onshore Mortgage Recovery Fund IV, L.P.	150
PIMCO BRAVO Fund III Onshore Feeder, L.P.	250
Park Square – PSERS Credit Opportunities Fund (Increase)	150
Total (2017)*	\$ 925

* Total 2017 new commitments exclude \$75M commitment to Bain Capital Special Situations Asia since this commitment will be funded via PSERS' existing managed account with Bain Capital Credit

- Future commitments of \$600 - \$800 million per year will allow PSERS to maintain a 10% target to the asset class over time
- Completed two new co-investments with ICG; will serve to diversify Private Debt Co-Investment Program (“PD Internal”)

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Middle Market & Tax Reform – Lots of Winners / Some Losers

- Corporate tax rate reduced from 35% to 21% and corporate AMT repealed
 - ↑ Profitable companies with limited pre-reform deductions
 - ↔ Price-taker companies in commoditized industries that must pass savings on to customers to avoid losing market share
- Deductibility of interest expense limited to 30% of adjusted taxable income (equates to EBITDA)
 - ↑ Companies with moderate leverage and liquidity
 - ↓ Companies with interest expense >30% of EBITDA (high leverage / low liquidity), with negative impact greatest on those in cyclical industries
- Immediate expensing of purchase of equipment and other capital investments permitted (until 2023)
 - ↑ Companies with capital intensive business models
 - ↔ Companies with low capital intensity
- Deductibility of net operating losses reduced from 100% to 80%
 - ↓ Issuers subject to a high degree of industry or economic cyclicality
 - ↓ Companies with positive cash flows and net losses (non-cash items such as write-down of intangibles)
 - ↓ Post-restructuring / Chapter 11 companies with large deferred tax assets on balance sheet

Tax Reform – Implications for Investors

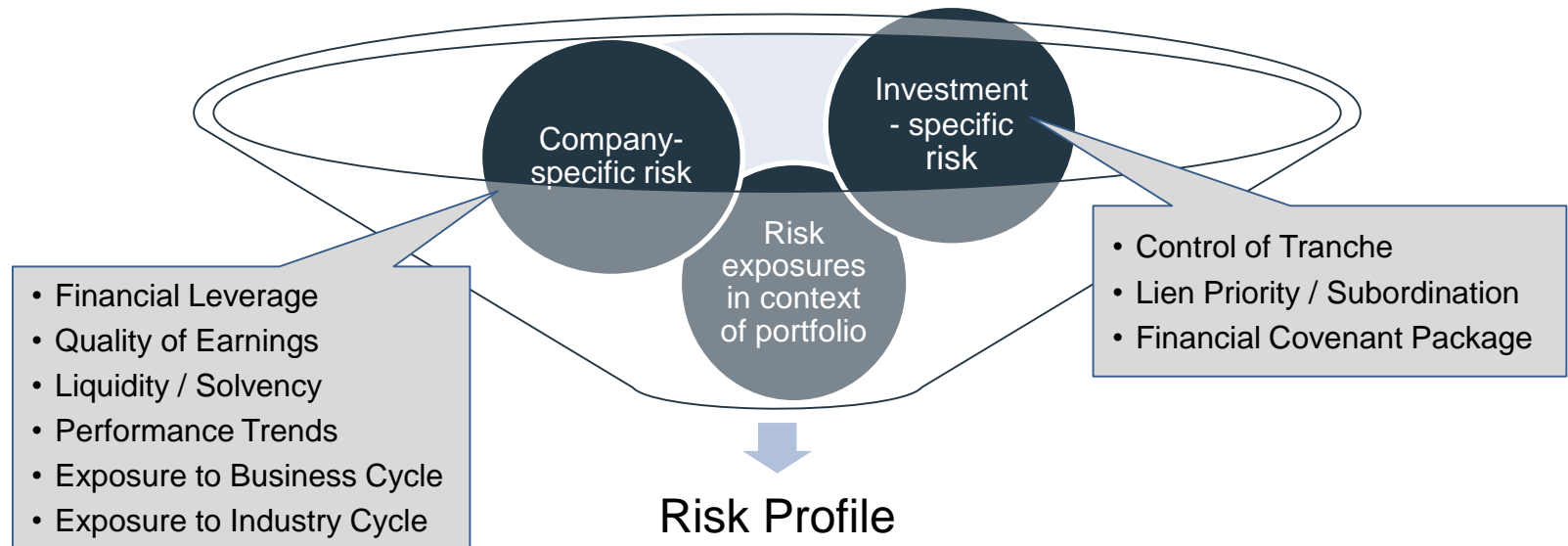
Potential Benefits:

- Debt Investors:
 - Debt of the ~80 - 85% of companies for which tax reform is expected to have a net positive cash flow impact should have lower probability of default and loss given default, leading to better outcomes for debt investors.
- Equity Investors:
 - Increased post-reform cash flow will accrue to equity holders through higher distributions / valuations.

Potential Drawbacks:

- Debt Investors:
 - For the companies whose cash flow is negatively impacted by tax reform, the interest deduction cap based on % of EBITDA exacerbates cyclicalities because as cash flow falls, there is a corresponding reduction in the size of the interest tax shield.
- Equity Investors:
 - The returns generated through the application of leverage to portfolio companies is diminished by the reduction in the size of the interest tax shield.

Considerations for 2018



Tax reform must be evaluated on a company-specific and investment-specific basis as each condition of tax reform has offsetting effects, and each company will be impacted in varying degrees.

Questions for 2018

- Is the amount of deductible interest limited by the 30% cap? If not, cash flow impact as a result of tax reform will likely be positive. Hence, this is the first question to ask.
- If yes, does credit documentation include interest coverage or fixed charge coverage covenant?
 - In this situation a leverage covenant (Debt/EBITDA) does not protect investors from potential downside of tax reform because EBITDA is a pre-tax and pre-interest measure (i.e. a proxy for operating cash flow)
- To what degree is the company subject to industry-specific and economic cyclicality?
- Where does the investment rank in the capital stack / what is the lien priority?

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Portfolio Snapshot ¹

- Portfolio performance was positive during the year
 - Net value change of \$445.3M
 - Positive 1-Year point-to-point IRR of 10.9%

PSERS High Yield/Private Credit Portfolio			
(\$M)	9/30/2016	9/30/2017	Change
Active Partnerships	38	41	3
Inactive Partnerships	2	2	-
Active GP Relationships ¹	15	16	1
Capital Committed ²	\$9,198.0	\$9,812.3	\$614.3
Unfunded Commitment	\$2,468.0	\$2,447.3	(\$20.7)
Paid-In Capital	\$6,919.4	\$7,715.7	\$796.3
Capital Distributed	\$4,457.2	\$5,186.0	\$728.8
NAV	\$4,080.4	\$4,593.1	\$512.7
<i>Evergreen</i>	\$1,371.5	\$1,716.2	\$344.7
<i>Finite Life</i>	\$2,704.0	\$2,877.3	\$173.3
MoC	1.2x	1.3x	0.1x
Avg. Age of Commitments	3.8 years	4.6 years	0.8 years
Since Inception Performance			
Portfolio Net IRR ³	8.5%	8.8%	30 bps

¹ The High Yield/Private Credit Portfolio includes PD Internal investments and Oxygen currency hedge; however, these investments are not reflected in the Active GP Relationship count.

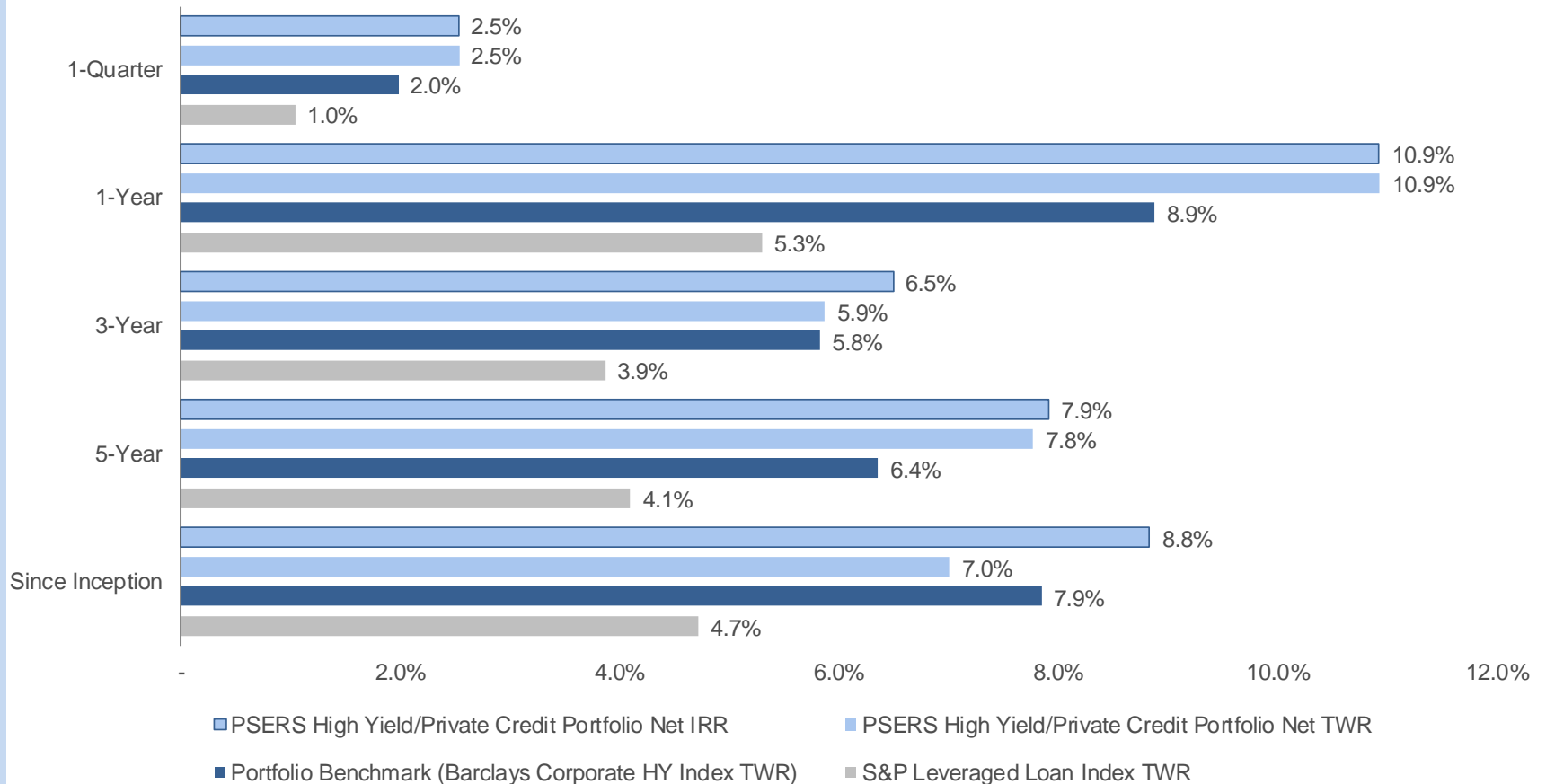
² The change in capital committed during the period is attributable to fluctuations in exchange rates for non-US denominated funds, new commitments made during the period, and an increase in commitment to existing funds

³ Net IRR includes fees paid to General Partners

Source: Hamilton Lane

Time Horizon Performance (IRR/TWR)*

As of 9/30/17



Note: The Total Portfolio returns include hedging of foreign currency since June 2015; prior to this date, the foreign currency was not hedged

Note: Barclays US Corporate High Yield Index and S&P Leveraged Loan Index data provided by Aon.

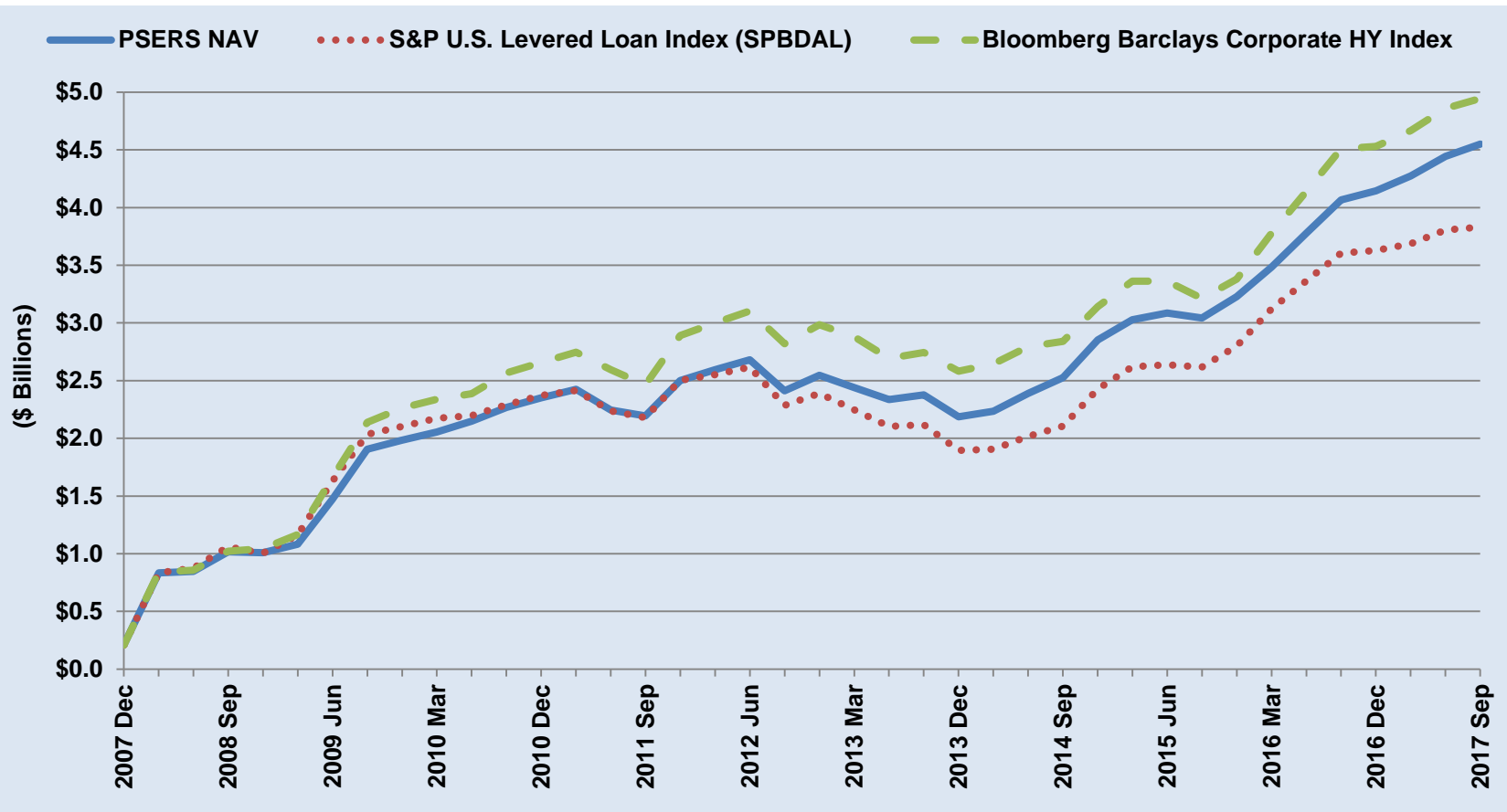
* Dollar-weighted (IRR); Time-weighted (TWR)

** Since Inception date: October 2007



PSERS NAV vs. Public Market Equivalents

As of 9/30/17

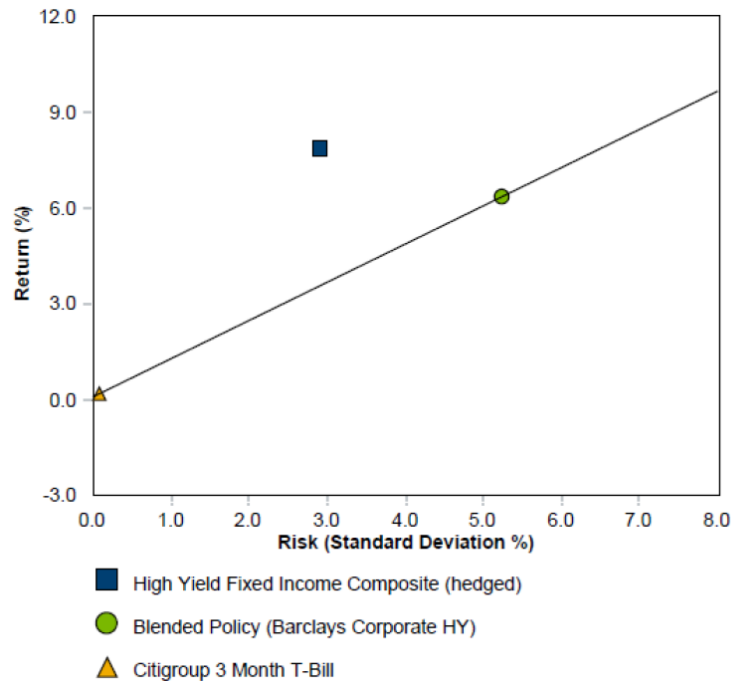


PSERS NAV	\$4,551.1
NAV if in Barclays HY Bond Index	\$4,944.4
<i>Value-added</i>	<i>(\$393.3)</i>
NAV if in S&P/LSTA Loan Index	\$3,831.6
<i>Value-added</i>	<i>\$719.5</i>

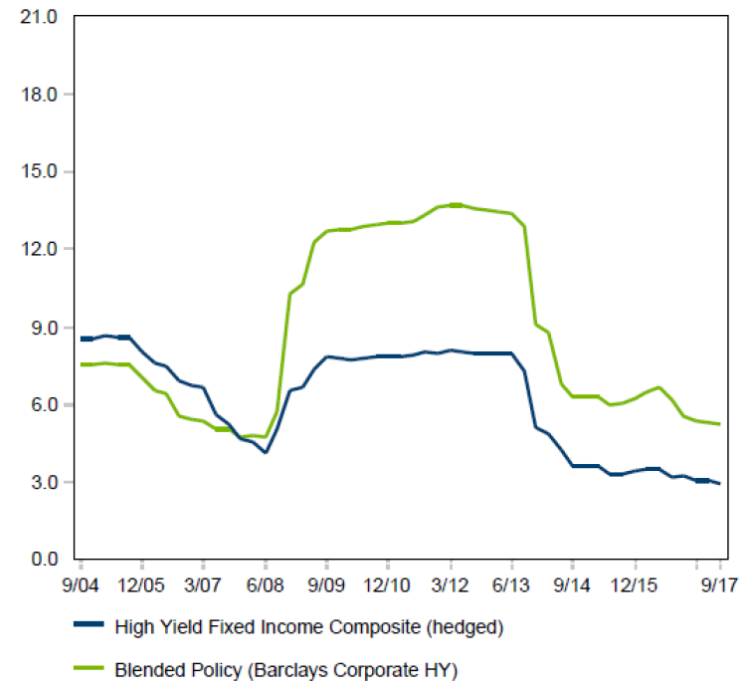
HY Composite – 5-Year Risk Profile vs. Policy Index

As of 9/30/17

Annualized Return vs. Annualized Standard Deviation



Rolling 5 Years Standard Deviation



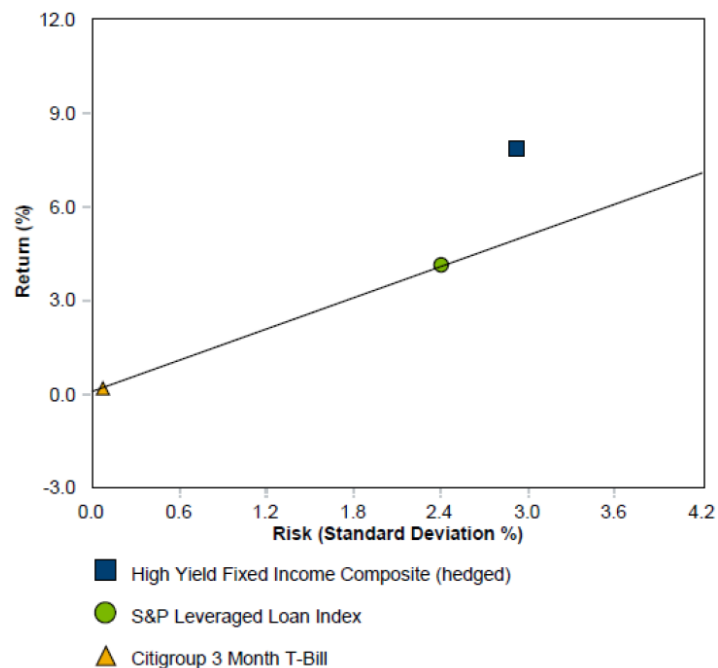
5 Year Historical Statistics

	Active Return	Tracking Error	Inf. Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Cor.
High Yield Composite (hedged)	1.30	4.61	0.28	0.23	2.55	6.08	0.27	7.84	2.92	0.48
Blended Policy (Barclays HY Index)	0.00	0.00	N/A	1.00	1.17	0.00	1.00	6.36	5.24	1.00
Citigroup 3 Month T-Bill	-6.13	5.22	-1.17	0.03	N/A	0.18	0.00	0.19	0.08	0.16

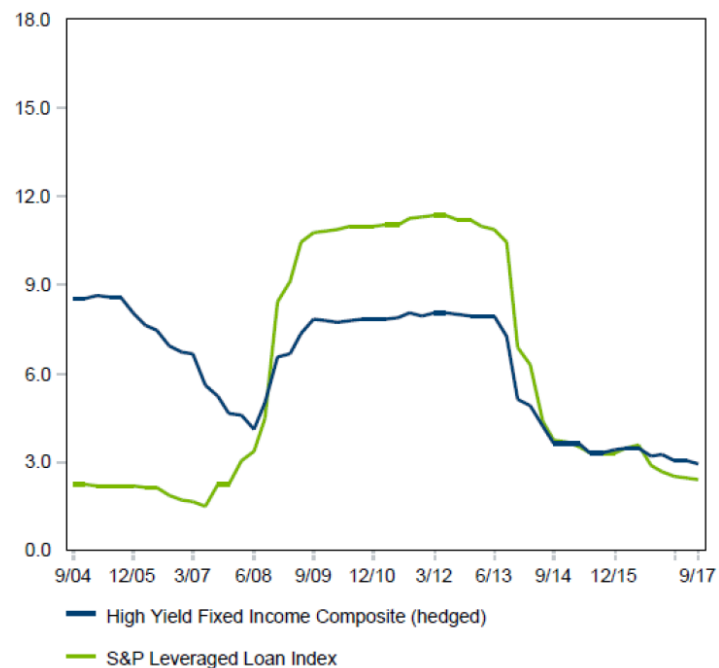
HY Composite – 5-Year Risk Profile vs. S&P LLI

As of 9/30/17

Annualized Return vs. Annualized Standard Deviation



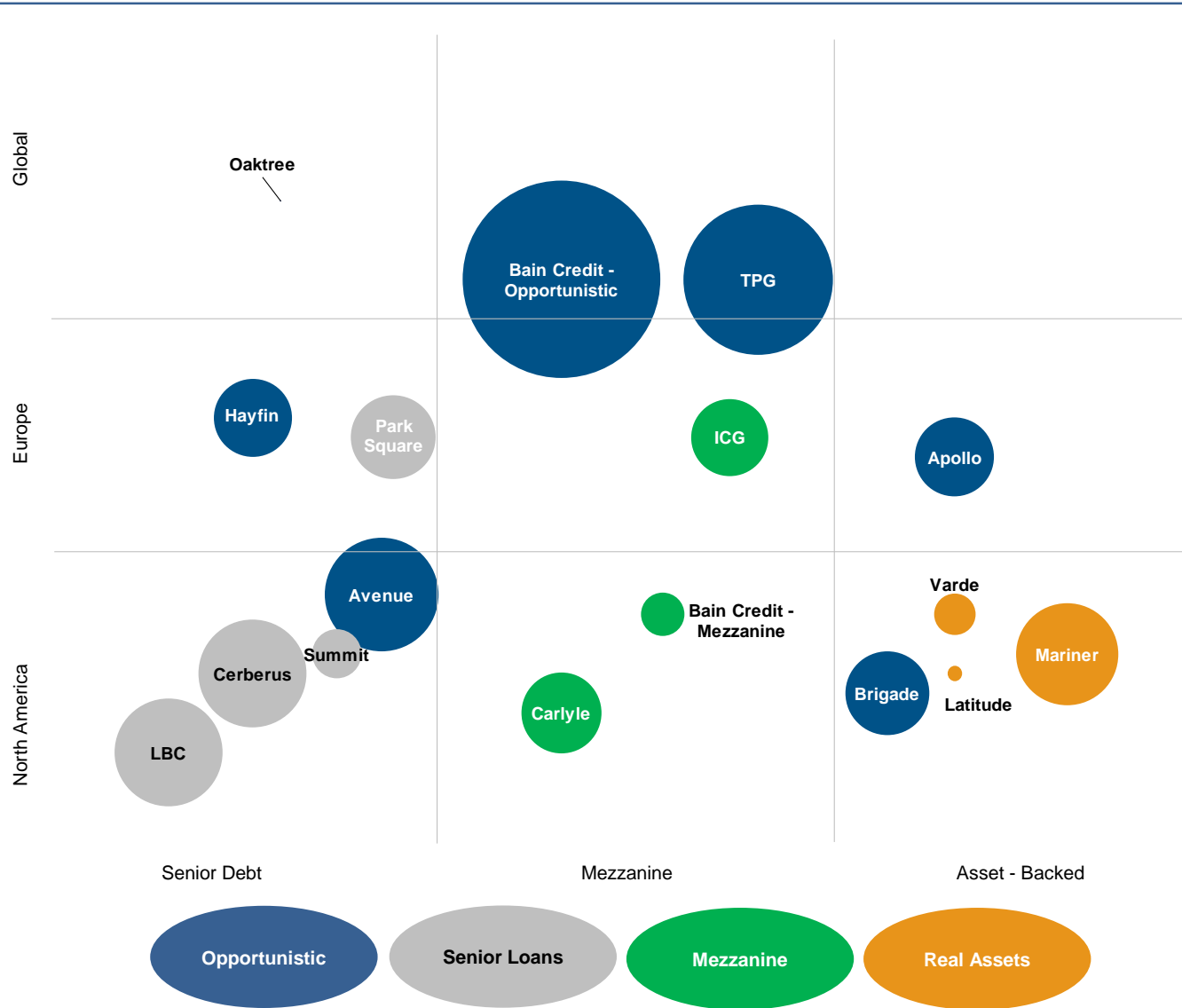
Rolling 5 Years Standard Deviation



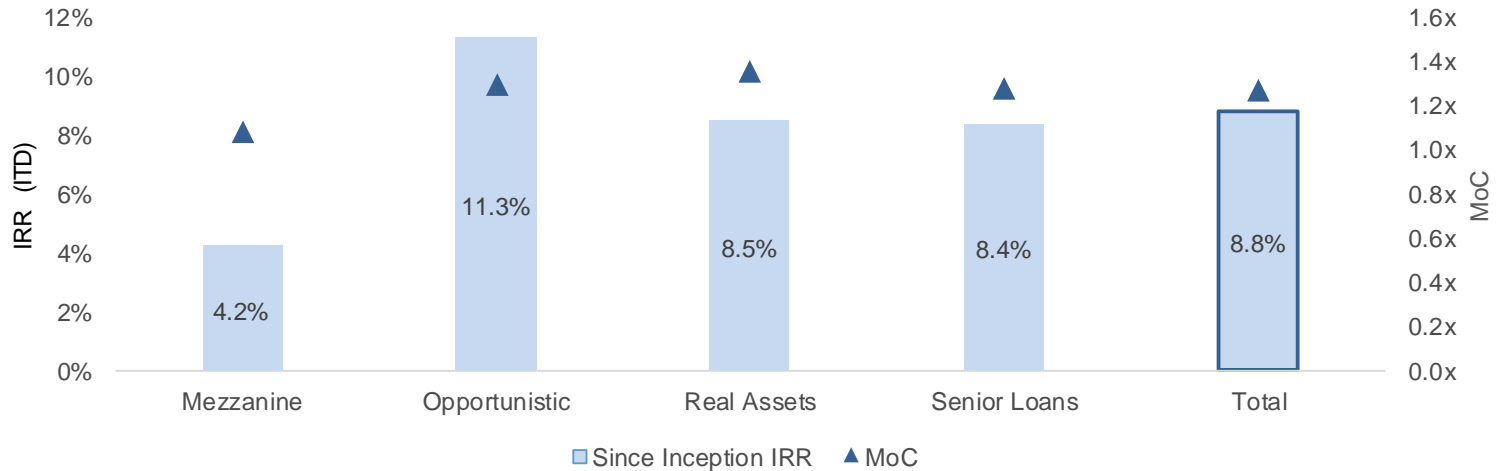
5 Year Historical Statistics

	Active Return	Tracking Error	Inf. Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Cor.
High Yield Composite (hedged)	3.56	2.72	1.31	0.24	2.55	5.32	0.60	7.84	2.92	0.49
S&P Leveraged Loan Index	0.00	0.00	N/A	1.00	1.61	0.00	1.00	4.10	2.41	1.00
Citigroup 3 Month T-Bill	-3.86	2.40	-1.61	0.02	N/A	0.17	0.00	0.49	0.08	0.14

Manager Exposure by Security Type & Geographic Focus



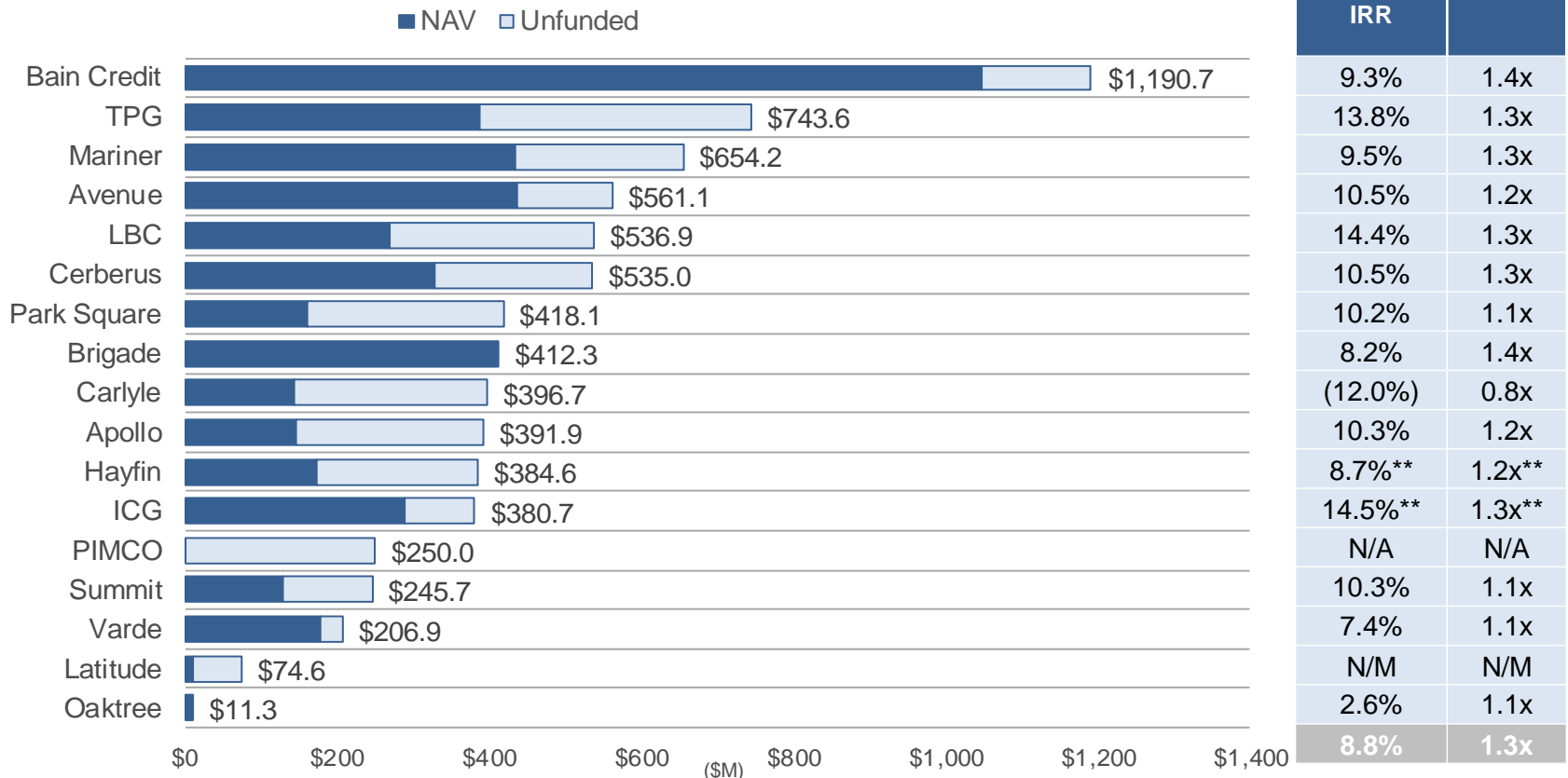
Performance Summary by Strategy



Strategy	NAV (\$M)	MoC	1 QTR IRR	1 YR IRR	3 YR IRR	5 YR IRR	Since Inception IRR
Mezzanine	\$672.4	1.1x	4.7%	11.4%	(0.9%)	3.5%	4.2%
Opportunistic	1,862.5	1.3x	2.6%	11.9%	8.1%	9.0%	11.3%
Real Assets	620.6	1.4x	2.5%	8.9%	7.3%	7.9%	8.5%
Senior Loans	1,437.6	1.3x	2.6%	10.9%	7.9%	8.6%	8.4%
Total	\$4,593.1	1.3x	2.5%	10.9%	6.5%	7.9%	8.8%

Total Exposure / Performance by Relationship

\$7.4 billion total exposure across 17 sponsors; comprised of \$4.6 billion NAV and \$2.8 billion undrawn capital



* Total Exposure figures include post Q3'17 commitments to Mariner (\$150.0M) and PIMCO (\$250.0M)

** IRR and MoC figures are presented in local currency (EUR). In the case of Hayfin, returns were derived by taking a weighted average (based on USD reported NAV) of Fund I and Fund II. Local returns given commitments are denominated in both EUR and USD

Note: The Oxygen currency hedge, liquidated investments, and PD Internal Program investments have been excluded from chart but are included in performance totals



Exposure / Performance by Vintage Year

As of 9/30/17

Historical Vintage Year Commitments



VY	Total Exposure ¹ (\$M)	Since Inception IRR	MoC
2007	\$11.3	6.3%	1.3x
2008	86.0	13.9%	1.4x
2009	367.5	8.9%	1.6x
2010	221.0	9.8%	1.4x
2011	427.0	9.9%	1.4x
2012	994.4	4.6%	1.1x
2013	653.1	6.8%	1.1x
2014	1,313.9	9.3%	1.2x
2015	1,926.1	17.6%	1.2x
2016	634.5	16.2%	1.1x
2017*	805.8	2.6%	1.0x
Total	\$7,440.5	8.8%	1.3x

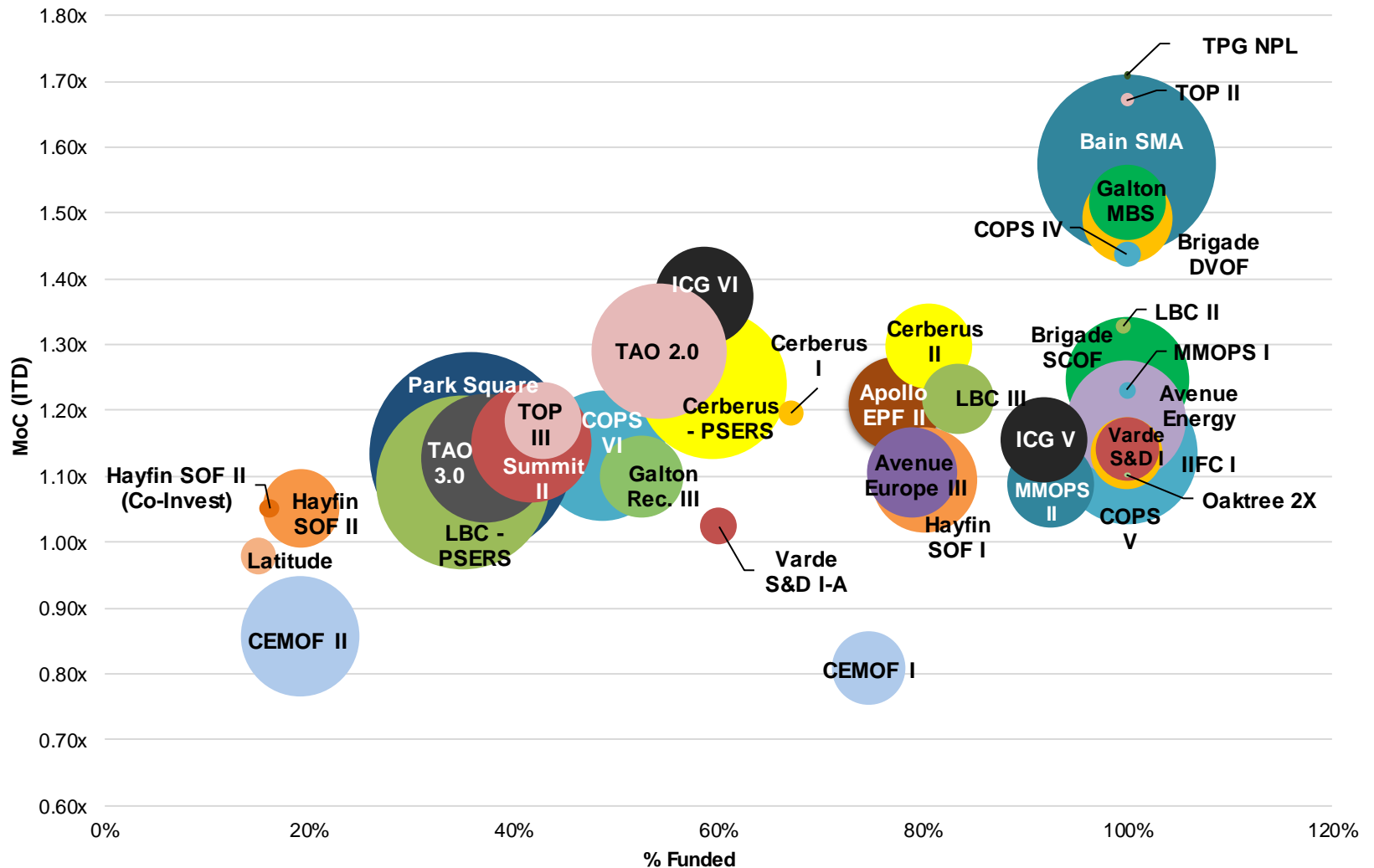
¹ Total Exposure = NAV + Unfunded Commitments

* Total Exposure figures include post Q3'17 commitments to Mariner (\$150.0M) and PIMCO (\$250.0M)

Note: The above analysis takes into account the vintage year of the fund, not necessarily when PSERS committed capital

Source: Hamilton Lane

Total Exposure (MoC & Percent Funded) by Active Manager



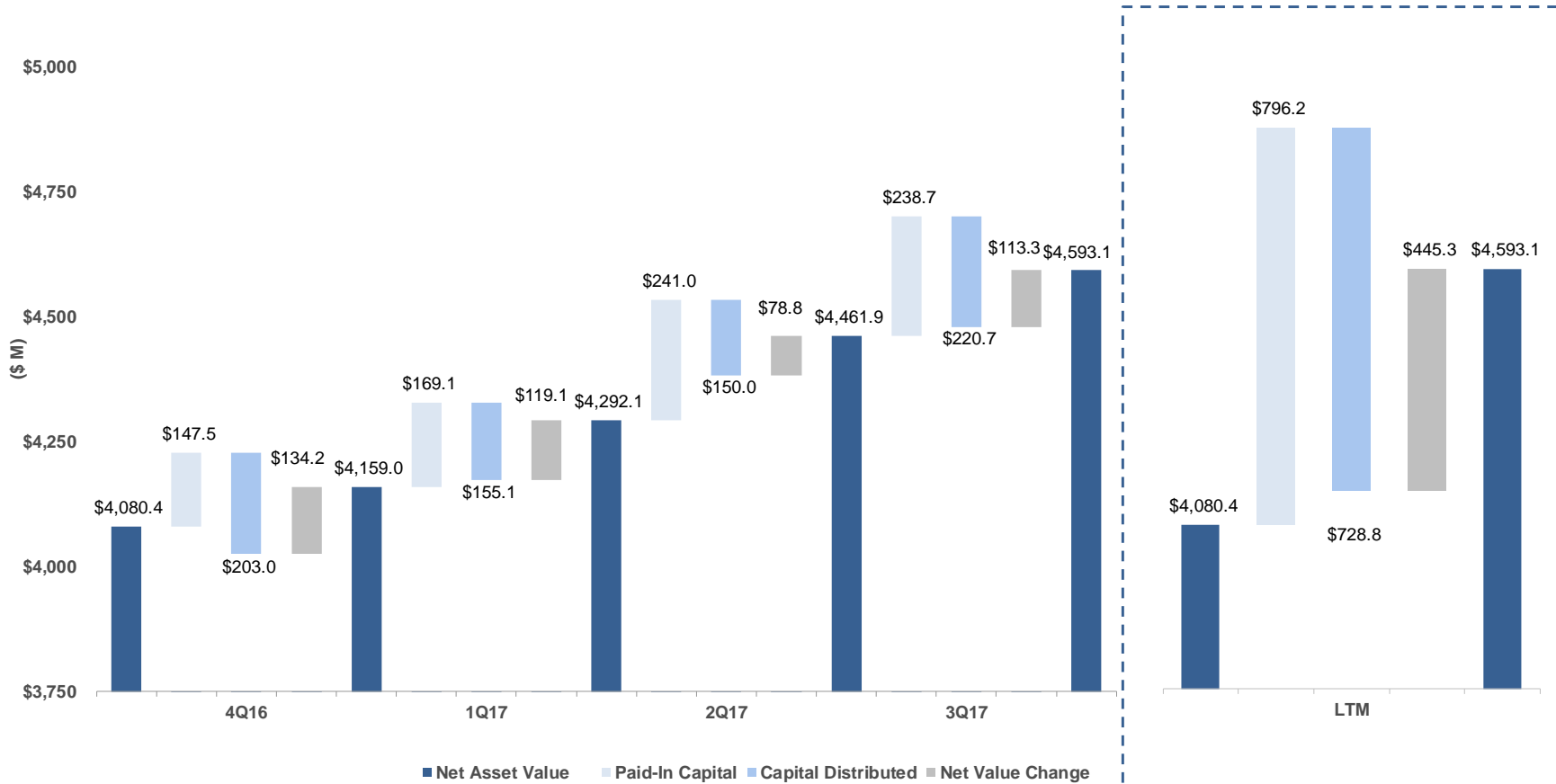
Note: The Oxygen currency hedge, liquidated investments, and PD Internal Program investments have been excluded from chart but are included in performance totals

Source: Hamilton Lane

Net Value Bridge

As of 9/30/17

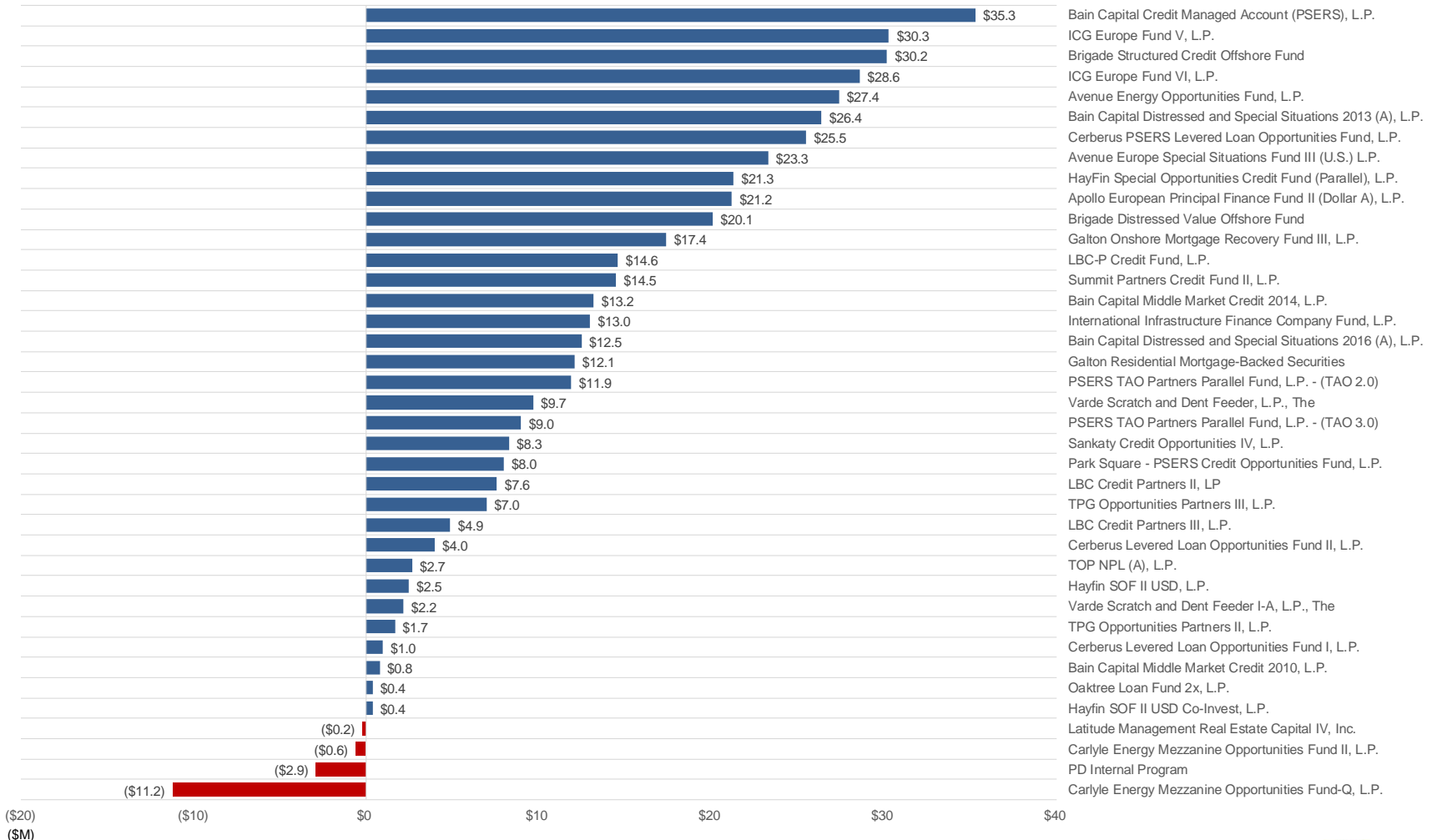
Net Value Change isolates the realized and unrealized performance of the underlying investments made by partnerships in the Portfolio. The Net Value Bridge illustrates these movements



LTM Valuation Movements

As of 9/30/17

Portfolio appreciated \$445.3 million for the last 12 months (+10.9%)



Note: The Oxygen currency hedge, liquidated investments, and investments generating no value change during the year have been excluded from chart; however, their performance has been included in Total Portfolio Appreciation

Source: Hamilton Lane



Top 5 Contributors/Detractors

As of 9/30/17

(\$M) Investment	VY	LTM Appreciation	09/30/17 NAV	1-Yr IRR	Since Inception IRR
Bain Capital Credit Managed Account (PSERS), L.P.	2009	\$35.3	\$367.5	10.6%	8.9%
ICG Europe Fund V, L.P.	2012	\$30.3	\$155.3	18.6%	7.4%
Brigade Structured Credit Offshore Fund	2014	\$30.2	\$255.5	13.4%	8.8%
ICG Europe Fund VI, L.P.	2015	\$28.6	\$132.8	66.5%	66.2%
Avenue Energy Opportunities Fund, L.P.	2015	\$27.4	\$243.7	12.9%	11.4%
Appreciation (Top 5)		\$151.9	\$1,154.9	15.5%	9.3%
Appreciation (Remaining 31)		\$317.2	\$3,241.9	10.6%	9.2%
Total Appreciation (36)		\$469.1	\$4,396.9	11.8%	9.2%

(\$M) Investment	VY	LTM Depreciation	09/30/17 NAV	1-Yr IRR	Since Inception IRR
Carlyle Energy Mezzanine Opportunities Fund-Q, L.P.	2012	(\$11.2)	\$100.0	(12.7%)	(12.6%)
PD Internal Program	2013	(\$2.9)	\$42.0	(16.0%)	(19.3%)
Carlyle Energy Mezzanine Opportunities Fund II, L.P.	2015	(\$0.6)	\$43.9	(2.7%)	(6.6%)
Latitude Management Real Estate Capital IV, Inc.	2017	(\$0.2)	\$10.8	NM	NM
Depreciation (Top 4)		(\$14.9)	\$196.7	(11.2%)	(13.2%)
Total Depreciation (4)		(\$14.9)	\$196.7	(11.2%)	(13.2%)

Total Portfolio (41)¹		\$445.3	\$4,593.1	10.9%	8.8%
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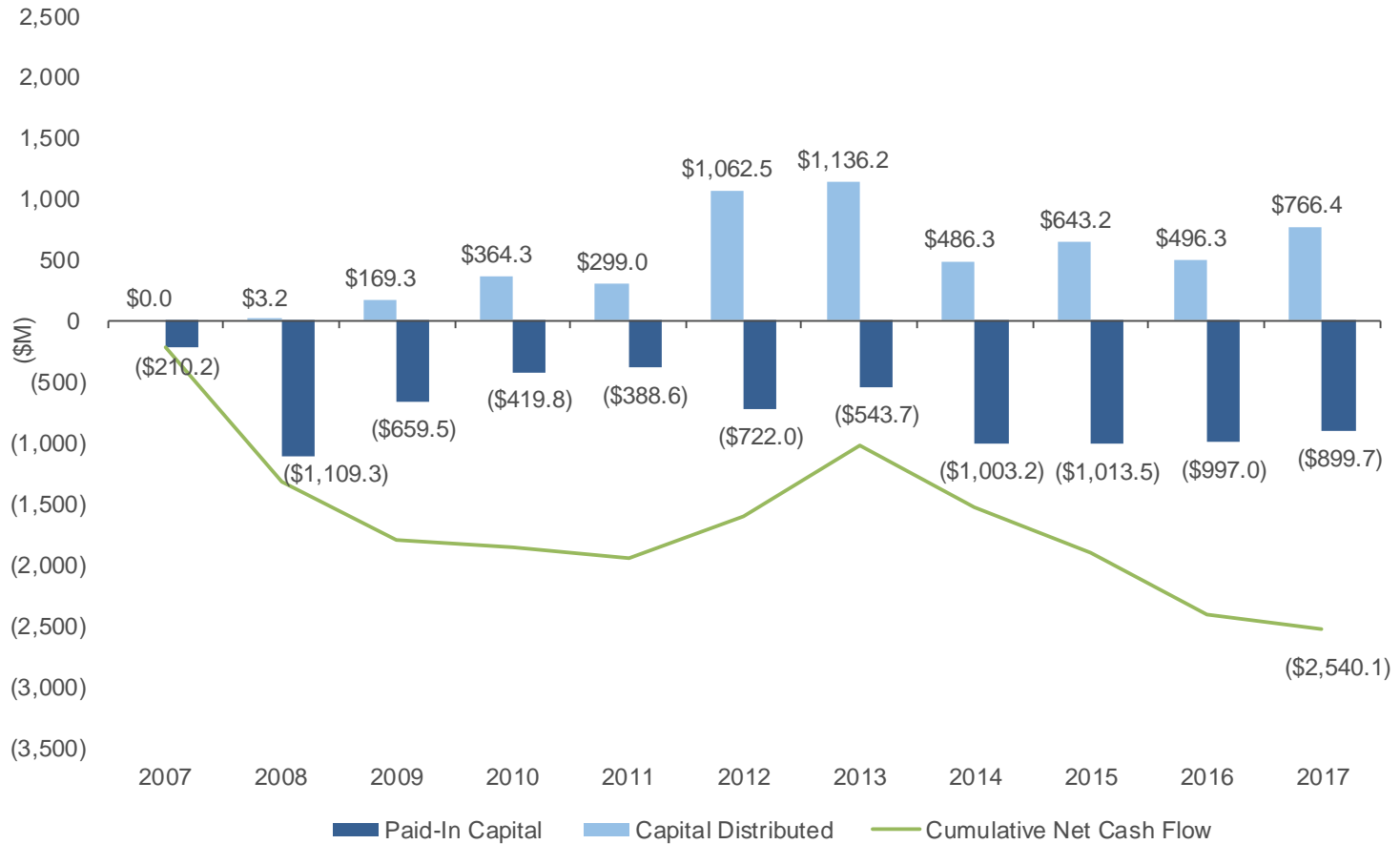
Note: Liquidated investments and the Oxygen currency hedge are excluded from fund counts presented on this slide

¹ Performance relating to liquidated investments, the Oxygen currency hedge, and investments generating no value change during the year are excluded from the Appreciation/Depreciation subtotals, but are included within Total Portfolio return figures

Annual Cash Flow

As of 12/31/17

High Yield/Private Credit Portfolio Cash Flow



Note: Cash Flow totals as of December 31, 2017 subject to change following final review and approval of data

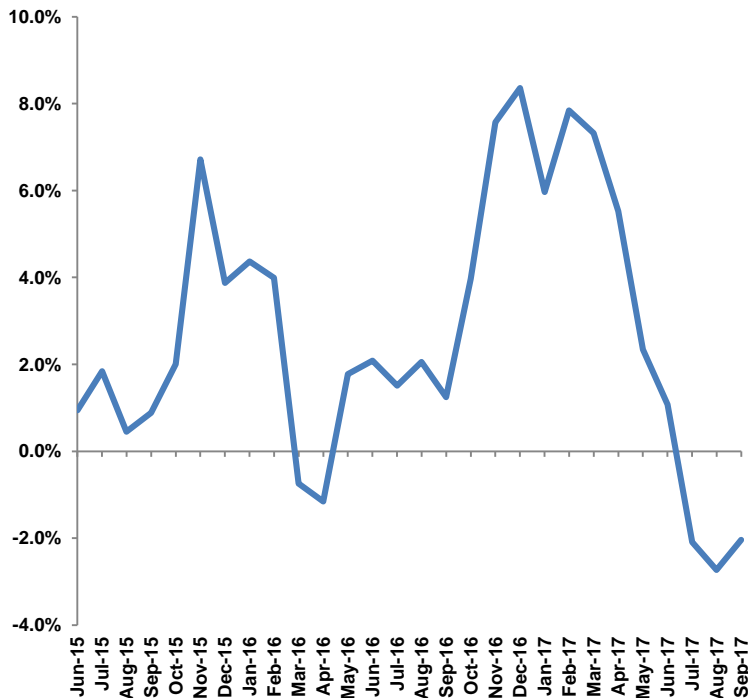
Source: Hamilton Lane

Oxygen Performance

As of 9/30/17

- Initiated currency hedge (Oxygen) in June, 2015 to mitigate against adverse FX movements in non-USD denominated partnerships (EUR/USD)
- (-2.0%) annualized return on invested notional value since inception (currently €319 million)
 - (-\$4.3 million) cumulative P&L through September 30, 2017

Cumulative P&L (%)



Cumulative P&L (\$)



Key Takeaways

- Portfolio (based on dollar-weighted IRR) outperformed the policy benchmark over all time periods
- Private Credit offers strong risk adjusted returns with lower volatility
- Continue to take advantage of expansive private credit opportunity set across wide range of strategies
- Remain focused on complementary strategies with potential for portfolio to earn net double-digit returns
- Continuously monitor market / regulatory developments

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PSERS - Rationale For Private Credit

While conventional public fixed income plays an important role in PSERS' portfolio, offering liquidity, lower volatility, and diversification, it is important to recognize its drawbacks and limitations, including:

- Low potential returns, particularly in a period of low and rising interest rates
- Opportunity set that tends to focus on investment grade, liquid sectors that are generally efficiently priced
- Terms and structures that are dominated by borrowers and investment bankers, rather than lenders
- Exposure to segmented markets that can be dominated by technical factors such as the need for yield
- Poor alignment of interests between borrowers and lenders
- Exposure to negative corporate event risk
- Decreasing liquidity of public HY in times of crisis negatively affecting prices (e.g. spread widening due to ETF flows, not fundamentals)
- Rising risks of anti-bondholder actions by corporations and leveraged buyouts by the private equity industry

Private strategies in fixed income markets overcome many of these deficiencies by offering:

- Higher potential returns
- Better investor rights and protection
- Risk premia for specialized knowledge
- Access to markets overlooked by traditional fixed income managers; idiosyncratic risk
- Better alignment of interests between borrowers and lenders

For these reasons, PSERS began transitioning its public high yield allocation to include various private credit structures in 2007:

- Today, PSERS' high yield allocation is entirely allocated to private structures
- HY allocation target increased to 10% (up from 8%) in October, 2017

What is Private Credit?

Private Credit can be defined as: all credit which is not traditional investment grade government or corporate debt.

More Liquid Alternative Credit	High Yield	High yield bonds are higher coupon debt obligations with lower credit ratings versus investment grade bonds. The additional spread is due to higher corporate credit (or default) risk. These bonds are typically issued by public companies and are tradable, but are less liquid than investment grade bonds, earning an added illiquidity premium.
	Bank Loans	Bank loans are private debt obligations senior in the capital structure (over high yield) typically issued by companies as part of a leveraged buyout (LBO), hence they are also known as leveraged loans. The loans are typically secured on assets and are floating rate, resulting in lower interest rate duration versus high yield bonds. The asset is less liquid versus high yield, resulting in an added illiquidity premium.
	Structured Credit	Structured credit bonds are debt securities whose value is determined by a pool of underlying loans. Typically these are loans that produce regular cash flows. By grouping these often small liquid loans into one structure, public securities can be offered to investors with different risk/return profiles. (e.g. MBS, ABS, CLOs)
	Emerging Market Debt	Emerging market debt (EMD) consists of sovereign or corporate credit from emerging economies, carrying higher political, credit and currency risk (for local-currency-denominated bonds).
Illiquid Alternative Credit	Direct Lending	Includes loans to private companies, privately placed debt of public companies, or loans backed by real assets (real estate, infrastructure and so on). Following post-crisis financial regulation, traditional bank lending activity has dropped dramatically, providing an opportunity for private, non-bank lenders to fill these voids. Maturities, regions and borrower types can vary, leading to idiosyncratic return drivers and better diversity.
	Distressed Debt	Debt of public companies at or near bankruptcy, defined as bonds rated CCC or below or those with spreads 10% over treasuries. This can also include distressed real asset loans where the collateral value has fallen below the loan value and non-performing consumer, corporate or real asset loan pools (NPLs). Accessing distressed debt is often done through a more illiquid fund format, such as a drawdown vehicle, where managers can employ activist strategies to unlock value, such as leading a firm through bankruptcy/restructuring and recovering asset values.
	Specialty Finance	Includes niche strategies such as funding of litigation, films, insurance or global trade, leading to an uncorrelated return profile relative to liquid credit strategies. It can also include investing in securities issued by smaller lenders such as consumer, automobile borrowing, or other niche lending gaps due to a lack of traditional lenders (banks) post financial regulation.

Benefits of Private Credit

Return Profile

- Potential for enhanced current income/returns vs. public bonds due to illiquidity premium
- Limited reliance on EBITDA growth or price appreciation to achieve investment objectives

J-Curve Mitigation

- Management fee typically paid on invested capital
- Shorter term structure and typically faster deployment relative to private equity/VC
- Cash distributions on quarterly basis during investment period are typical

Downside Risk Protection

Distressed Debt

- ✓ Purchase discounts
- ✓ Self-liquidating

Senior Lending

- ✓ Capital structure seniority
- ✓ Cash flow

Opportunistic Credit

- ✓ Tradeable
- ✓ Coupons
- ✓ Discount to par

Diversification

- Performing and distressed
- Corporate, real estate, real assets and consumer collateral
- Idiosyncratic strategies and opportunistic themes within large asset classes

Benefits / Drawbacks vs. Other Asset Classes

Private Credit	vs. Private Equity	vs. High Yield Bonds	vs. Hedge Funds
Potential Benefits	<ul style="list-style-type: none"> - Typically lower fees - Management fee often paid on invested capital - J-Curve mitigation - Current yield - Shorter fund duration - Capital structure seniority - Narrower range of outcomes - Not dependent on IPO/equity markets for exit 	<ul style="list-style-type: none"> - Benefit from rising rates (floating rate) - Senior vs. subordinated - Yield pick-up from illiquidity premium - Less price volatility / technical-driven selling - Lower EBITDA leverage - Covenant protection 	<ul style="list-style-type: none"> - Suitable structure for less liquid assets - Preferred return or hard hurdle - Improved transparency - Reduced investor adjacency risk - Reduced cash performance drag - Less whipsaw risk
Potential Drawbacks	<ul style="list-style-type: none"> - Upside is capped - GP track record duration often limited - Generally less operational control 	<ul style="list-style-type: none"> - Less liquidity - Slower capital deployment - Less market transparency - Smaller issuers - Higher fees 	<ul style="list-style-type: none"> - Less liquidity - No ability to short - Less able to pivot with opportunity

Source: Aksia LLC

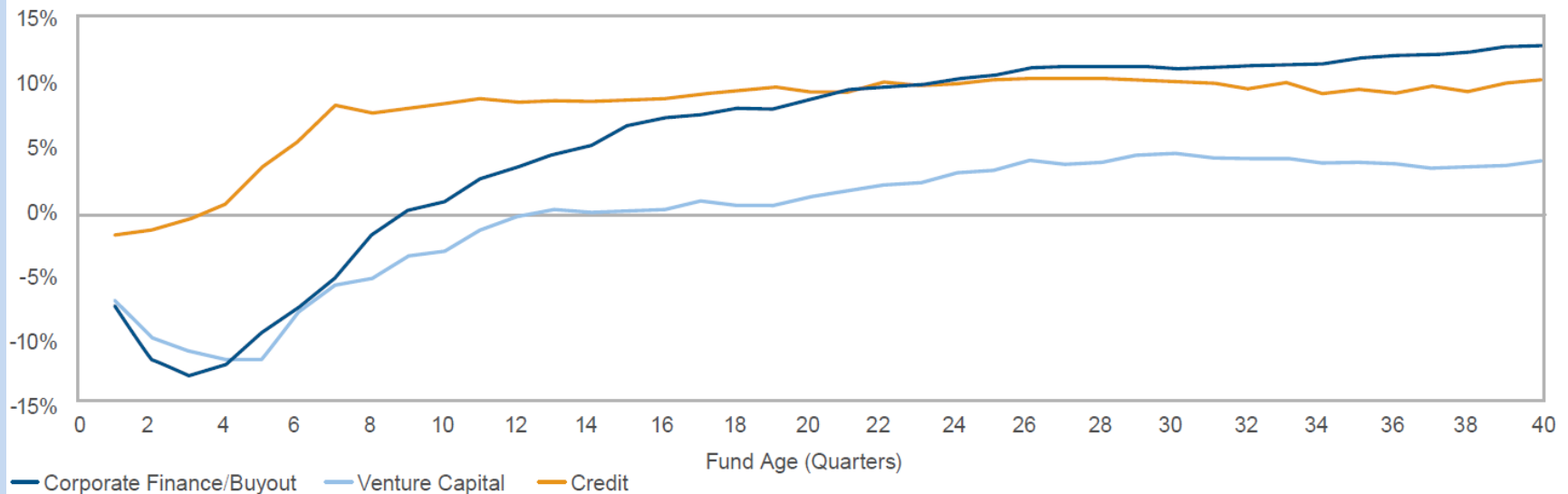
In Private Credit, we are being paid for illiquidity, in contrast with Public HY where there is an illusion of liquidity

Minimal J-Curve

- Private credit mitigates the J-curve; produces higher returns for first 5-years of investment period
- In the longer term, private credit is less volatile than buyout funds with nearly the same total rate of return

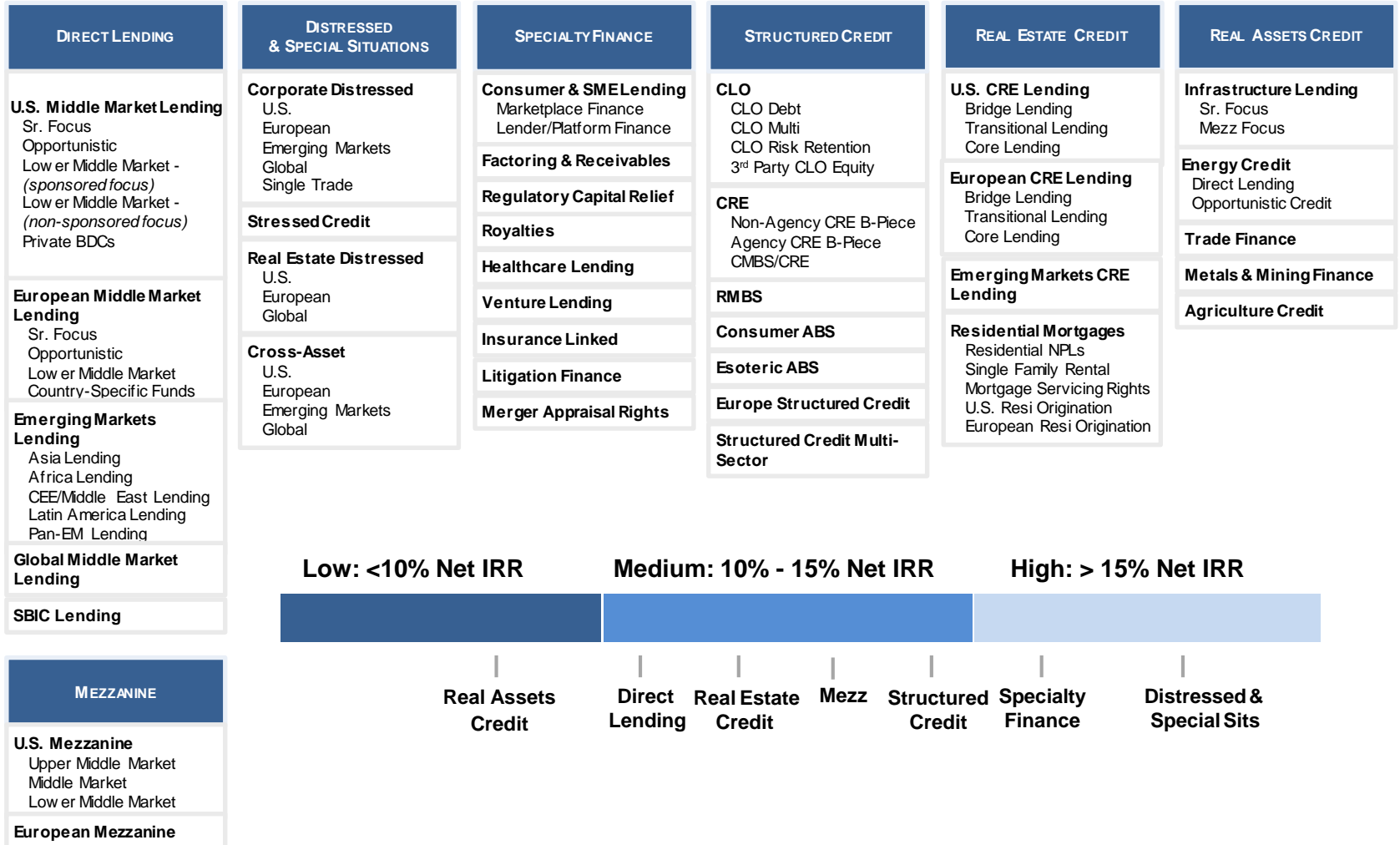
Median IRR J-Curves by Strategy

Vintage Years 1974-2015



Source: Hamilton Lane Fund Investment Database (June 2016)

Expansive Private Credit Opportunity



Benchmark Considerations

- Barclays HY Bond Index is the official policy benchmark of PSERS' HY allocation
- However, the S&P/LSTA Leveraged Loan Index may provide a more accurate proxy of PSERS' underlying private credit exposure
 - Market value-weighted index designed to measure the performance of the U.S. leveraged loan market based upon market weightings, spreads and interest payments
 - Biggest difference (vs. HY Bond Index) is capital structure position and interest rate duration
 - Bonds have much longer duration, so they have benefited over past seven years as rates have fallen post GFC

Manager Selection Considerations

- Macro (Portfolio Level)
 - Portfolio Fit – Is there a place for the manager in our portfolio and are they complementary to what we already have?
 - Market Opportunity - Does the manager's strategy address a compelling market opportunity?
 - Competition – What's the manager's competitive advantage? Do they have an edge?
- Micro (Investment Level)
 - Experienced, dedicated and cohesive senior management team
 - Proven track record, preferably across market cycles
 - Demonstrated proprietary sourcing capabilities
 - Workout capabilities, if necessary
 - Alignment of interest. Is the manager investing their own money?
 - Favorable legal protections
 - Willingness to be our partner, a partnership goes 'both ways'



COMMONWEALTH OF PENNSYLVANIA
PUBLIC SCHOOL EMPLOYEES' RETIREMENT SYSTEM

High Yield / Private Credit Asset Class Review

**James F. Del Gaudio,
Portfolio Manager**

March 8, 2018