



COMMONWEALTH OF PENNSYLVANIA
PUBLIC SCHOOL EMPLOYEES' RETIREMENT SYSTEM

Investment Fee Report FY 2018

John B. Kemp, CTP - Managing Director, Investment Operations and Risk
Raymond J. Schleinkofer, CFA - Senior Portfolio Manager, Traditional Investment Strategies
Darren C. Foreman, CAIA - Senior Portfolio Manager, Non-Traditional Investment Strategies

December 6, 2018

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- **Introduction and Total Fund Summary**
- Traditional Investments Fee Discussion
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- Appendix

Past Annual Fee and Expense Presentations

- 2015: Summary overall expenses and summary-level investment fees by asset class
- 2016: Summary overall expenses and detail-level investment fees by asset class
- 2017: Investment Expenses Primer (educational), Deal-by-Deal vs. Whole Fund Waterfall (educational) and summary overall expenses
- 2018: Summary overall expenses and fee negotiation illustrations
- 2019: ???

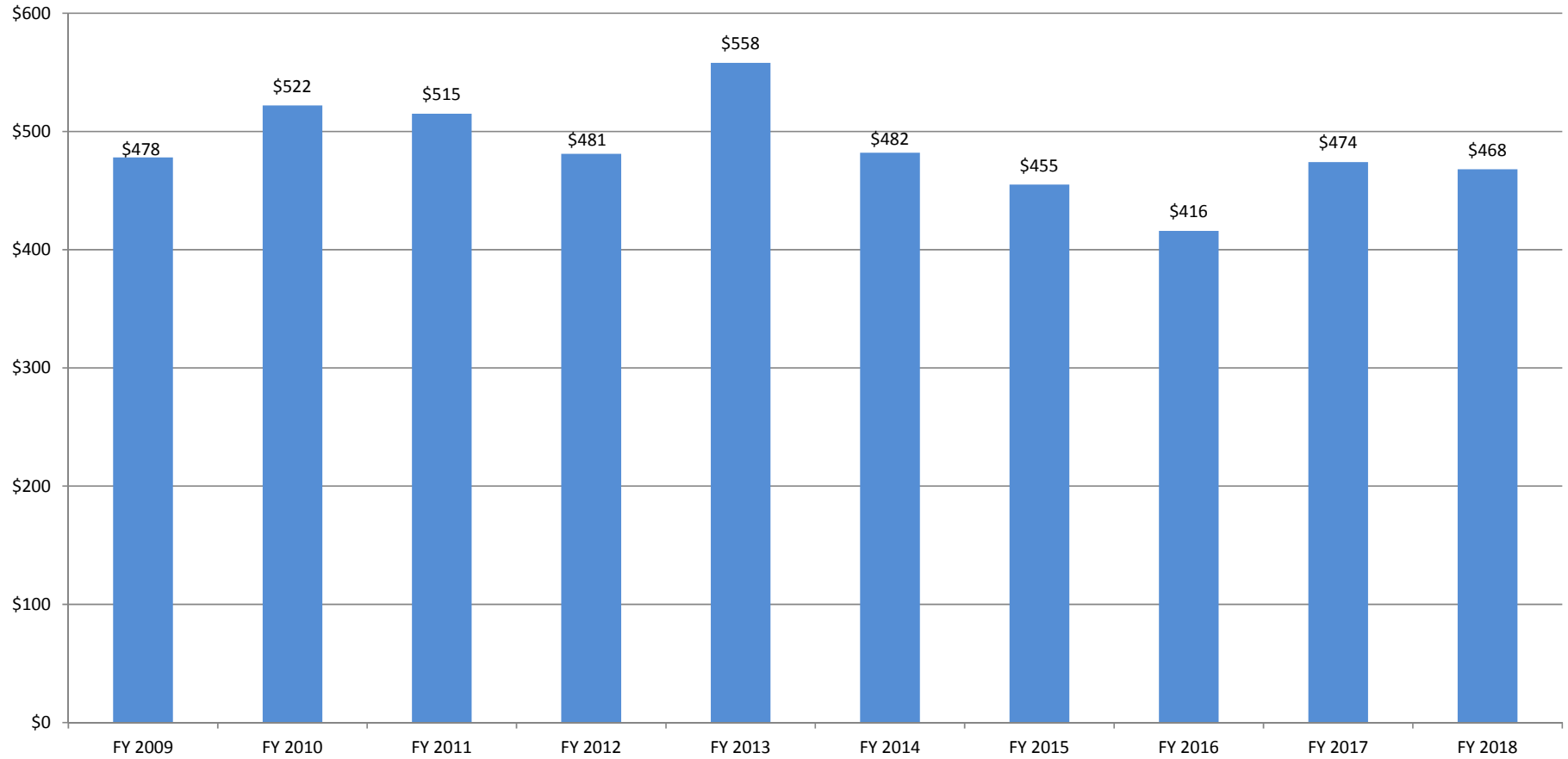
Recent Related

- Investment Fees have been discussed at several meetings this year, including...
 - Response to PSERS Resolution 2017-41 (August 2018)
 - Focus on investment manager cost efficiency
 - Emphasize greater use of internal management
 - Implementation of strategic asset allocation plan – no changes to asset allocation and risk/return profile
 - Focus on reducing base management fees
 - Base management fees are guaranteed; profit sharing is not guaranteed
 - Potential fee savings evaluated by asset class
 - Some of savings only can be realized if the Board has ability to hire additional investment professionals
 - No explicit investment management fee reductions goals or targets
 - General Partner Ownership Interest (October 2018)
 - Board agreed to create a working group to consider transparency topics (October 2018)

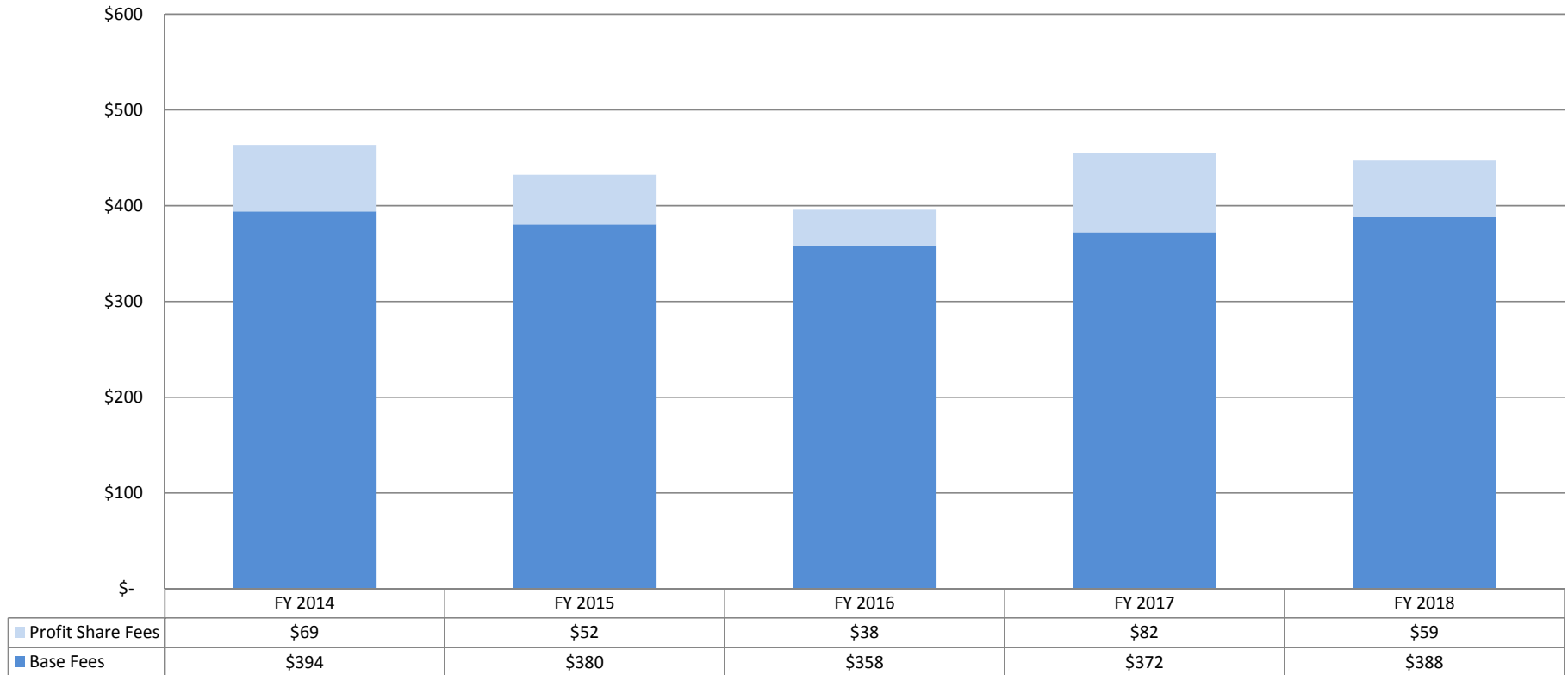
The Expense Analysis Challenge

- Peer to peer comparisons are not “apples to apples”
 - No uniform reporting convention exists
 - No uniform analysis framework exists
 - No guidance has been issued by GASB, GIPS, GFOA, etc.
 - Public Pension Funds can and do report and disclose expenses differently
- PSERS Has Used This Framework in Recent Years
 - Total Investment Expenses = External Manager Expenses + Internal Management Expenses + Other Expenses
 - Evaluate the **outperformance (Alpha)** we earned over the Board-approved policy benchmarks against the **investment expenses we paid**
 - Ask: Do the benefits justify the costs?

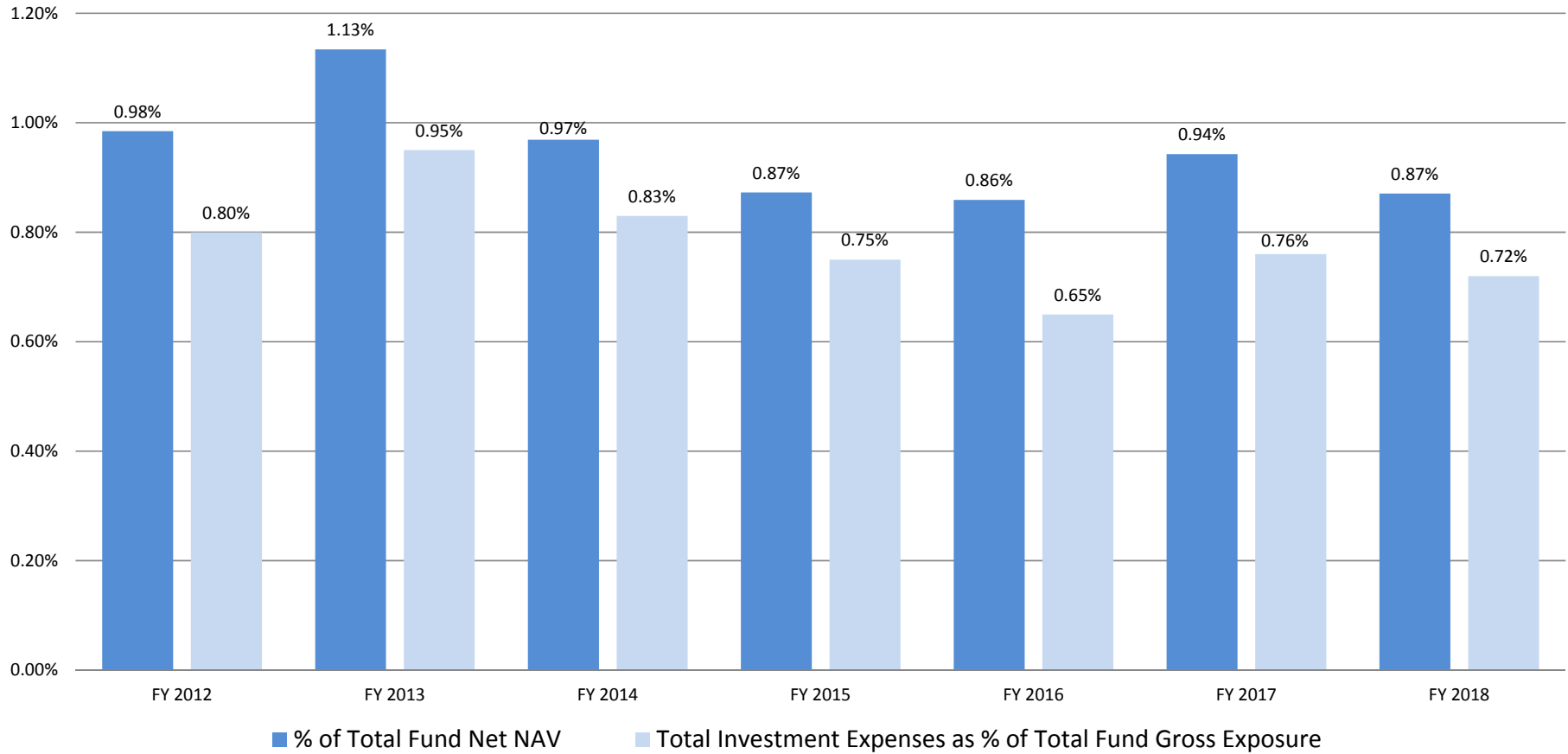
Total Investment Expenses



Base and Profit Share Expenses



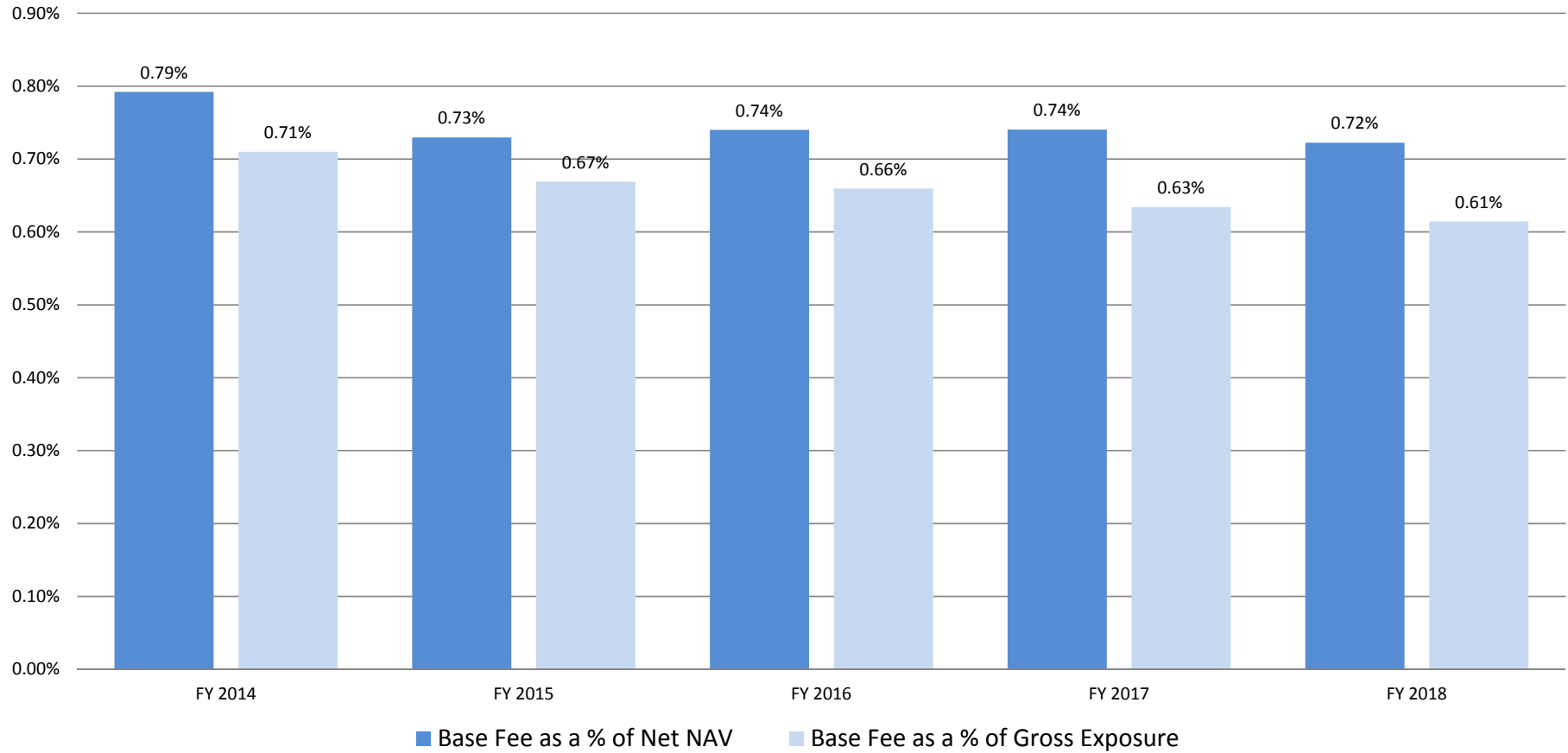
Total Investment Expenses



Calculated based upon quarterly NAV and gross exposure (NAV plus leverage)



Base Fee Expenses

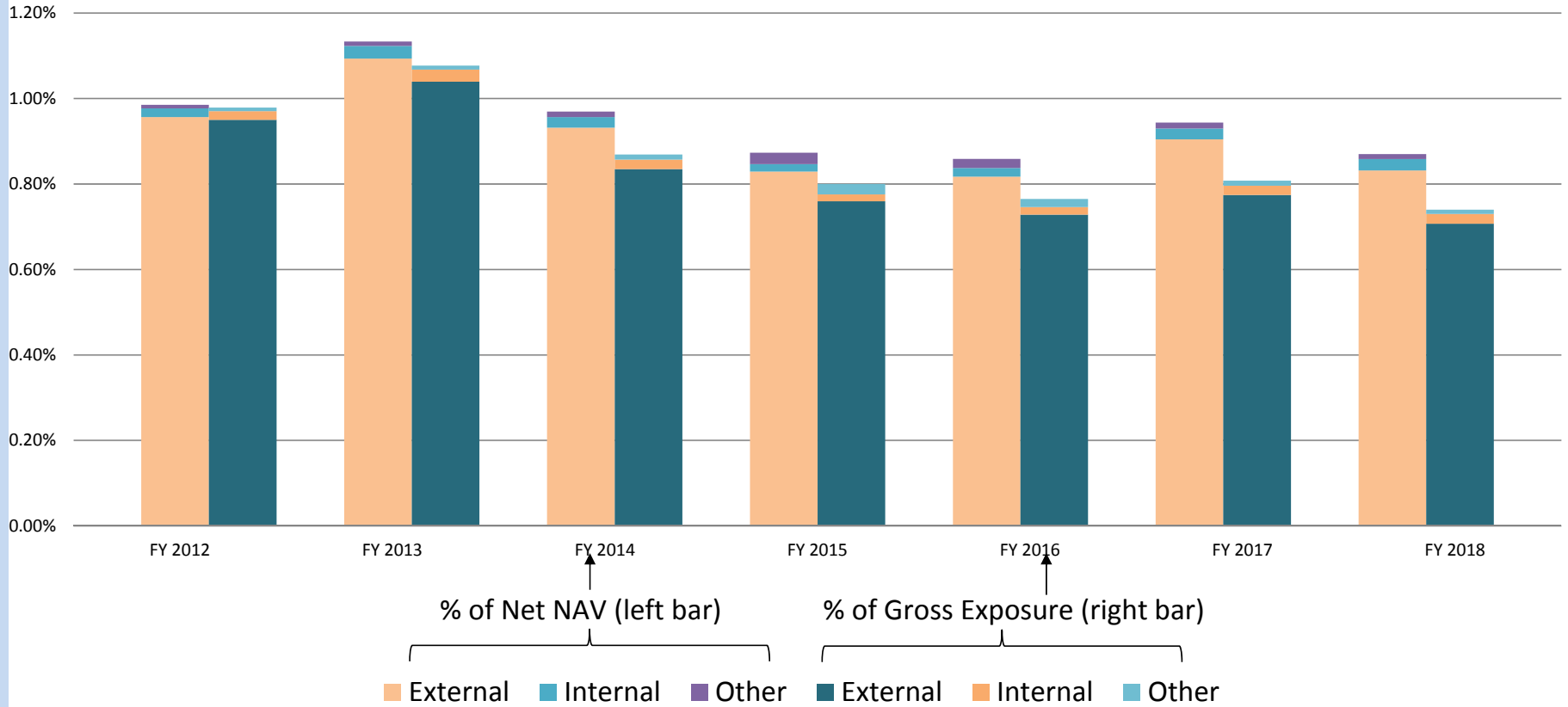


Calculated based upon quarterly NAV and gross exposure (NAV plus leverage)



Total Expenses Breakdown

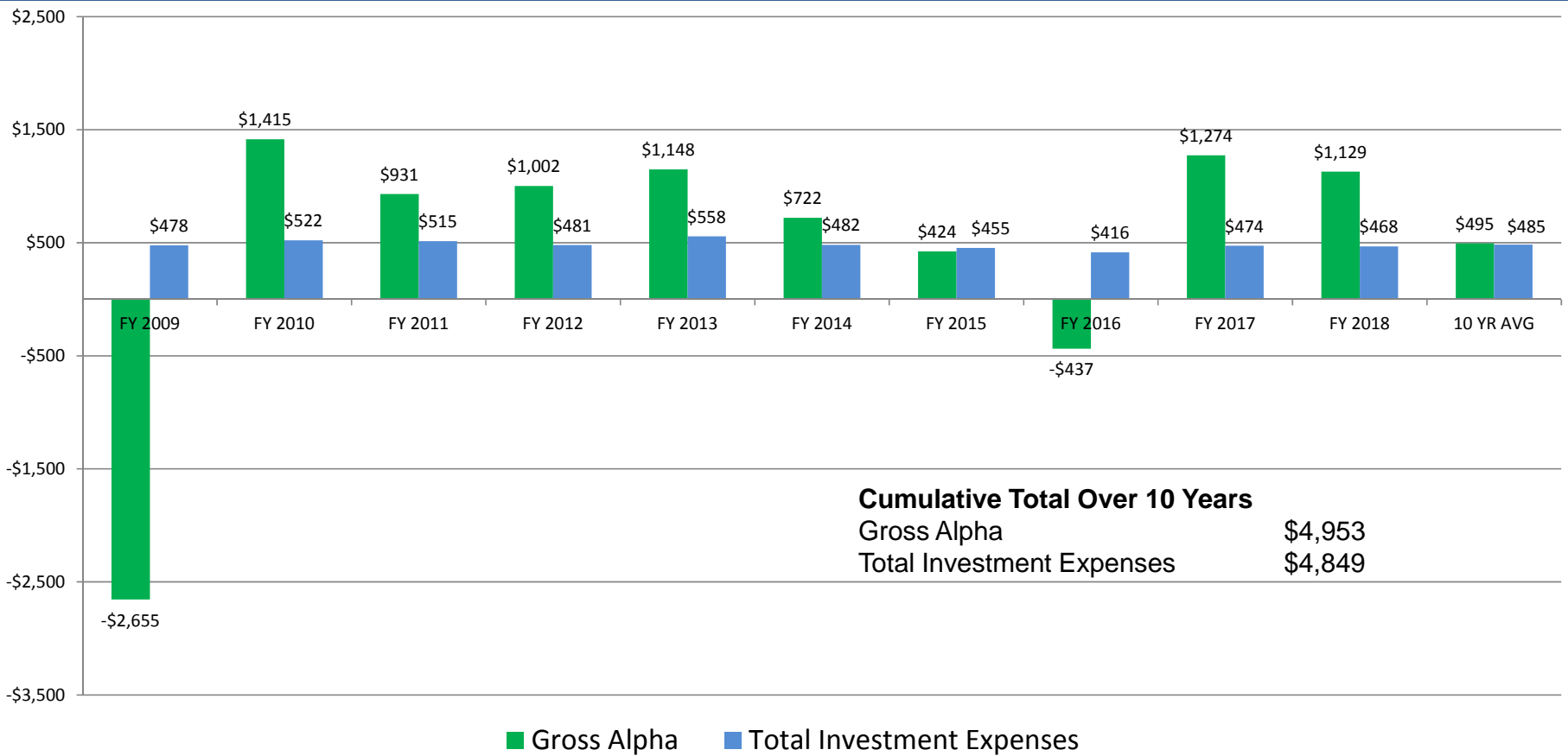
External vs Internal vs Other as a % of the Total Fund



Calculated based upon quarterly NAV and gross exposure (NAV plus leverage)
 Other Expenses include Consultant, Legal, etc.



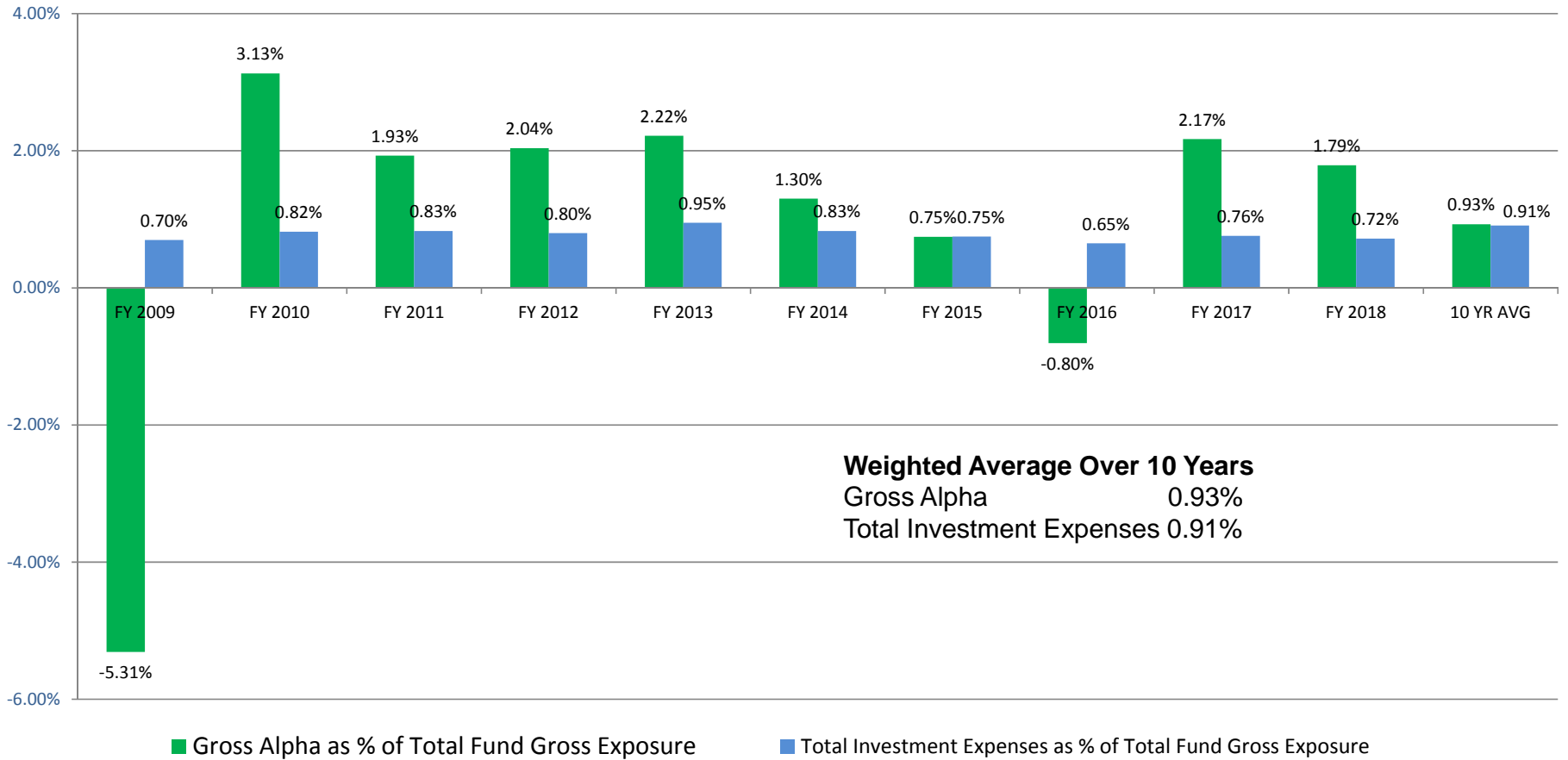
Total Investment Expenses vs Gross Alpha



Gross Alpha is excess earnings over the earnings of the relevant benchmark index without regard for investment expenses
 Dollar amounts in millions



Total Investment Expenses vs Gross Alpha



Asset Class Summary

INVESTMENT EXPENSES BY ASSET CLASS					
	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
External Management					
U.S. Equities	\$ 3	\$ 3	\$ 3	\$ 3	\$ 2
Non-U.S. Equities	\$ 18	\$ 24	\$ 24	\$ 25	\$ 28
Master Limited Partnerships	\$ 11	\$ 12	\$ 8	\$ 9	\$ 9
Fixed Income	\$ 82	\$ 84	\$ 82	\$ 109	\$ 111
Commodities	\$ 11	\$ 8	\$ 6	\$ 10	\$ 10
Real Estate	\$ 74	\$ 69	\$ 52	\$ 51	\$ 50
Private Equity	\$ 117	\$ 102	\$ 99	\$ 103	\$ 98
Absolute Return	\$ 141	\$ 117	\$ 102	\$ 123	\$ 115
Infrastructure	N/A	N/A	N/A	N/A	\$ 2
Risk Parity	\$ 6	\$ 13	\$ 18	\$ 23	\$ 22
External Management Total	\$ 463	\$ 432	\$ 396	\$ 455	\$ 447
Internal Management	\$ 12	\$ 9	\$ 10	\$ 13	\$ 14
Other	\$ 7	\$ 14	\$ 10	\$ 7	\$ 6
Total Investment Expenses	\$ 482	\$ 455	\$ 416	\$ 474	\$ 468
External Gross Exposure	\$ 40,642	\$ 39,934	\$ 36,709	\$ 38,873	\$ 39,800

Amounts in millions of dollars, totals may not sum due to rounding
Other Expenses include Consultant, Legal, etc.



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Traditional Investments Fee Discussion FY 2018

Raymond J. Schleinkofer, CFA - Senior Portfolio Manager, Traditional Investment Strategies

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Fee Negotiations

- We Derive Competitive Advantages from:
 - Scale: Ticket Sizes of \$100 million to \$200 million or more
 - Sovereign Status
 - Duration of Capital
 - Reputation
- We Exploit this Advantage Aggressively:
 - Request better terms at the start of the conversation
 - Committed to revisiting terms whenever a contract renews and at a contract's half life
 - Committed to revisiting every 2.5 years for evergreen structures
 - Will opportunistically engage the manager as opportunities are identified

Objectives In Negotiation

- **Fee Negotiation Goals:**

- Alignment of interest: Pay for performance not asset gathering
- Pay for alpha
- Ensure we receive the best available terms given our scale, entry point, and duration
- Fees do not exist in a vacuum
 - The point is to improve net performance

- **New Initiatives:**

- Longer crystallization periods and carry claw back
- Revenue share arrangements
- Multi-product fee netting
- Bring more assets in house where we can and alpha is low for asset class

Example # 1: Late to the game (Manager F)

- Manager F had agreed to provide first close investors a reduction in management fees and carried interest
 - The manager had already made one investment and committed to two more investments assuming fund raising would continue.
 - While the deals were attractive, the manager did not appreciate that fundraising would be challenging.
 - The fund and existing investors were at risk of over-concentration, exacerbating the fundraising challenge.
 - Our scale meant that the fund's diversification profile would improve substantially.
 - We were able to save 50 basis points of management fee and reduce carried interest from 20% to 14% despite our enhanced visibility into highly attractive deals already committed to by the manager.

Example # 2: New Manager (Manager G)

- Manager G is a recently launched manager in a capacity constrained strategy.
 - Their standard terms offered 1.5% management fee plus 20% carried interest with early investors offered a 5% preferred return.
 - We first negotiated a hard cap on capacity to protect long term alpha.
 - Next, we attacked the management fee reducing it to 0.50%.
 - The carrot? 3 year locked-up capital with rebalancing and a 27.5% carried interest plus recognition by a major consultant.
 - The ask? Convert the preferred return to a hard hurdle, boost the hard hurdle to 7%, and cap expenses.
 - We receive:
 - A large allocation to a capacity constrained strategy.
 - Very cheap beta
 - We keep over 70% of the alpha
 - They make more money than under standard terms if they deliver 20% or more per annum, and we do not pay carried interest if we earn less than 7%.

Illustration: Preferred Return against Hard Hurdle

Gross Return %	Net Return % with Preferred Return	Net Return % with Hard Hurdle
5%	4.00%	4.00%
6%	5.00%	5.00%
7%	6.00%	6.00%
8%	7.00%	7.00%
9%	7.00%	7.80%
10%	7.20%	8.60%
11%	8.00%	9.40%
12%	8.80%	10.20%
13%	9.60%	11.00%
14%	10.40%	11.80%
15%	11.20%	12.60%

- Return comparison using the following assumptions:
 - Management fee = 1%
 - Carried Interest/Profit Sharing Fee = 20%
 - Preferred Return/Hard Hurdle = 7%

Example # 3: Contract Renewal (Manager C)

- Manager C has been with PSERS since 2008. Returns during the recent contract period lagged the benchmark due largely to a single bad year that nevertheless was within expectations for the strategy.
 - At the time of renewal, we addressed performance. The manager quickly pointed out the longer term alpha generated in the account and their belief over time they would rebound.
 - We agreed with the analysis but asked them to demonstrate their conviction by moving from management fee only to lower management fee plus a profit share fee.
 - We were able to cut management fees in half in exchange for a 25% performance fee on performance over the index.
 - In scenarios where the manager delivers no alpha, we pay less than the cost of many comparable passive products.
 - In scenarios where they produce 2.25% of annualized alpha, they actually earn more.
 - We were then able to negotiate a beginning net operating loss credit of 150 basis points toward future performance fees (i.e. a retroactive high water mark).

Annual Base Fee Savings CY 2017 - 2018

Manager	Old/Standard Fee Structure	New/Agreed Fee Structure	Additional Features	Annual Savings
Manager A	1.35% management fee with no performance allocation	1.15% management fee with no performance allocation		\$ 1,229,047
Manager B	Blended 0.24% management fee and 8% performance allocation over market-based hurdle	Blended 0.24% management fee and 8% performance allocation over market-based hurdle plus 40 basis points		\$ -
Manager C	0.90% management fee with no performance allocation	0.45% management fee and 25% performance allocation over market-based hard hurdle	Initial loss carryforward of 150 basis points	\$ 1,353,521
Manager D	0.75% management fee with no performance allocation	0.25% management fee and 15% performance allocation over market-based hurdle plus 100 basis points		\$ 2,066,208
Manager E	0.20% management fee and 20% performance allocation over market-based hurdle	0.15% management fee with no performance allocation		\$ 750,000
Manager F	2.00% management fee and 20% performance allocation over market-based hurdle	1.50% management fee and 14% performance allocation over market-based hurdle		\$ 125,000
Manager G	1.50% management fee and 20% performance allocation over market-based hurdle	0.50% management fee and 27.5% performance allocation over a hard hurdle		\$ 2,000,000
Manager H	1.50% management fee and 20% performance allocation over market-based hurdle	1.40% management fee and 20% performance allocation over market-based hurdle		\$ 225,000
Manager I	Blended 0.89% management fee	Blended 0.89% management fee		\$ -
Annualized Base Management Fee Savings				\$ 7,748,776
Compounded Savings over 30 Years Discounted at 7.25%				\$ 765,718,152



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Non-Traditional Investments Fee Discussion FY 2018

Darren C. Foreman, CAIA - Senior Portfolio Manager, Non-Traditional Investment Strategies

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Fee Negotiations – Sample Categories

- Management fee reduction
- Impact of no fee/no carry co-investments
- Managed separate account

Management Fee Reductions

- Management fee reductions typically come in 3 forms
 - Fee discount based on size of your commitment
 - First time closing discount
 - Founders discount where the largest LP may receive a discount
- PSERS has saved approximately \$222 million in management fees since inception

Managed Secondary Separate Account Example (Currently Being Negotiated)

- Management fee of 0.50% of invested capital
- 7% preferred return
- 5% carried interest

Other Negotiated Economics

- Adding a preferred return
- End of life charge of the management fee
- A higher percentage of the transaction, board, monitoring fees, etc. that offset management fees
- No fee/no profit share co-investments
 - The example below reflects a 25% reduction in the management fee

Fund Commitment	\$	75,000,000
Management Fee		2%
Yearly Management Fee per Investment Period	\$	1,500,000
Co-investment	\$	25,000,000
No Management Fee		0%
Fund Commitment and Co-investment	\$	100,000,000
Net Management Fee		1.50%

How a GP Can Receive Greater than 20% Profit in a Given Year

- Example: In 2015, an LP invests \$100. The 2015 profits are \$8, all of which is received by the LP with the 8% preferred return.
- In 2016, the profit is \$12. The first \$2 goes to the GP in order to bring the profit share ratio to 80/20. This is called the “Catch up”. The remaining \$10 of profit from 2016 is then shared 80/20 between the GP and the LP.
- Therefore in 2016, the \$12 of profit is split \$8 to the LP and \$4 (33%) to the GP. However, the inception to date profit split is \$16 to LP and \$4 (20%) to the GP.

2015		
LP Investment	\$	100
Preferred Return		8%
Profit That is Received by LP	\$	8
2016		
Profit	\$	12
GP Catch up	\$	2
Remaining Profit Shared 80/20	\$	10
GP Share of 80/20	\$	2
LP Share of 80/20	\$	8
Total GP Profit	\$	4
Total LP Profit	\$	8
Inception to Date		
GP Profit	\$	4
LP Profit	\$	16

Record Keeping

- All fee negotiation emails are deposited into Tamale (PSERS' investment office document management system)

K4 Private Investors	Due Diligence - Fee...	Michael Tyler	Fee Negotiations
K4 Private Investors	Due Diligence - Fee...	Darren Foreman	Re: Are there any mgmt fee discounts in K4?

- All management fee discounts are kept current in Excel

Private Markets Annual Management Fee Savings				
Fund	Commitment	% Reduction	Annual Amount	4 Year Amount
			\$ 38,644,623	\$ 154,578,492

Base Fees Savings CY 2017- 2018

Manager	Old/Standard Fee Structure	New/Agreed Fee Structure	Additional Features	5 Year Savings
Manager J	1.50% management fee	1.00% management fee		\$ 2,250,000
Manager K	1.50% management fee on both unfunded and funded commitments	0.50% management fee on unfunded and 1.35% funded commitments		\$ 4,200,000
Manager L	2.00% management fee	1.50% management fee		\$ 3,750,000
Manager M	1.75% management fee	1.50% management fee		\$ 1,500,000
Manager N	0.75% management fee	0.50% management fee		\$ 1,250,000
Manager O	1.00% management fee	1.00% management fee		
Manager P	1.5% management fee	1.40% management fee		\$ 927,532
Manager Q	2.00% management fee	2.00% management fee		
Manager R	2.00% management fee	2.00% management fee		
Manager S	2.00% management fee	2.00% management fee		
Manager T	1.00% management fee on NAV and 0.50% management fee on undrawn commitments	0.675% management fee on NAV and 0.30% management fee on undrawn commitments for 2 years and then 0.90% management fee on NAV and 0.40% on undrawn commitments	2 Year Fee Discount Period	\$ 3,750,000
Manager U	1.75% management fee	1.75% management fee		
Manager V	1.75% management fee	1.75% management fee		
Manager W	1.75% management fee	1.75% management fee		
Manager X	1.50% management fee	1.50% management fee		
Manager Y	2.00% management fee	1.75% management fee		\$ 875,000
Manager Z	1.25% management fee	1.25% management fee		
Manager AA	1.50% management fee	0.80% management fee		\$ 7,000,000
Manager AB	2.00% management fee	2.00% management fee		
Manager AC	1.50% management fee	1.50% management fee		
Manager AD	1.00% management fee	1.00% management fee		
Manager AE	1.00% management fee	1.00% management fee		
Manager AF	1.75% management fee	1.00% management fee		\$ 4,500,000
Manager AG	2.00% management fee	1.85% management fee		\$ 750,000
Total Base Fee Savings				\$ 30,752,532

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Additional Example: Market Based Hurdle (Manager AO – Currently Being Negotiated)

- Manager AO has an established track record in a highly volatile niche market.
 - The manager offered a standard share class with a 1.25% management fee and an index-based hard hurdle.
 - They also offered a 0% management fee share class and 25% profit sharing fee over a 6% hard hurdle.
 - We liked the value proposition and alignment of the 0% and 25% class but preferred the market-based hurdle.
 - The manager specialized in rapidly growing emerging market equities. Over time, this beta would likely beat 6%.
 - We were able to secure an index-based, hard hurdle in exchange for a 3 year commitment.
 - We also secured 10% annual rebalancing rights and a 3 year profit sharing fee crystallization period.
 - The caveat: market based hurdles can lead to scenarios where a manager loses money but still receives a profit sharing fee by outperforming the index.

Additional Example: Not Always Successful (Manager I)

- PSERS was an anchor investor in manager I, a small capitalization international equity manager.
 - PSERS negotiated a cap on strategy assets of \$3B forcing the manager to refuse new investments.
 - Since 2008 Manager I has outperformed the index by 5.83% per annum with a 0.61 information ratio. Through market value appreciation, the manager had surpassed the fundraising cap in assets and has a wait list of investors willing to enter under higher fee terms.
 - Upon contract renewal, we requested a management fee reduction or a transition to performance fee.
 - The manager countered by requesting we remove our AUM cap.
 - We were unwilling to risk future alpha in exchange for a potential fee reduction.
 - We renewed the contract under existing terms. Documented the negotiation and expect to opportunistically reopen the negotiation in the future.

Additional Example: Fee Netting Arrangement (Manager AH)

- PSERS invests with Manager AH across multiple hedge fund strategies with an aggregate performance fee over a hurdle
 - Initial terms were a 0.95% management fee and 22.25% profit sharing allocation over an index-based hard hurdle.
 - Able to negotiate a greater of 0.65% management fee or 29% performance allocation over an index-based hard hurdle.
 - If the management fee is higher than the profit sharing allocation for an annual period, the difference is recouped on the subsequent period, so that the maximum aggregate fee for the combined period is 29%.
 - This structure has the manager receiving a lower % of gross alpha at gross aggregate returns below 11%.

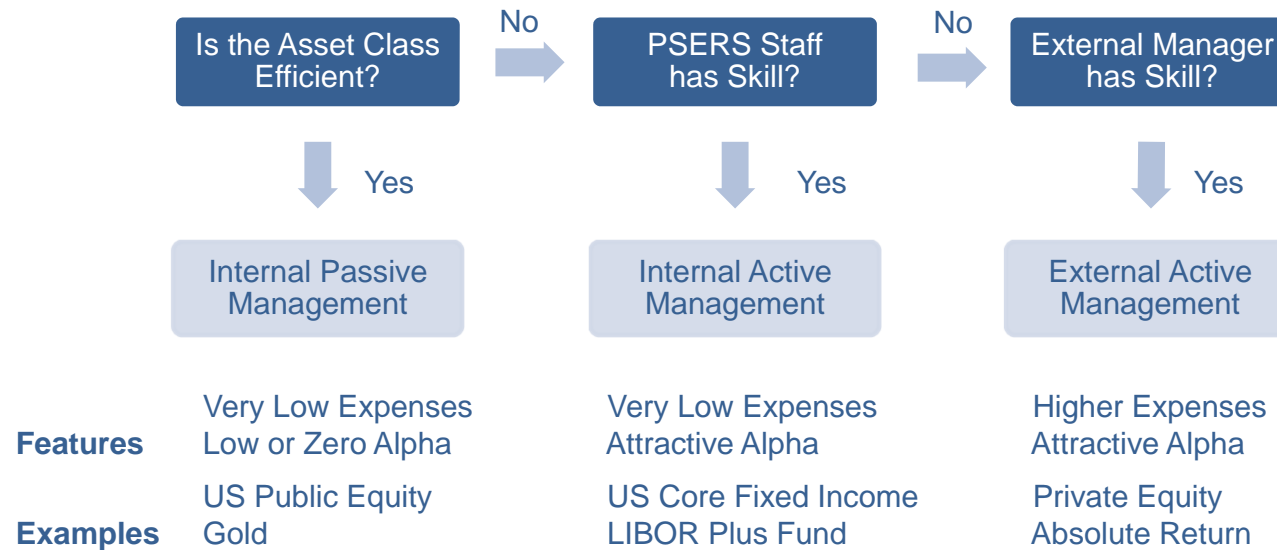
Additional Negotiated Fees 2017 - 2018

Manager	Old/Standard Fee Structure	New/Agreed Fee Structure	Additional Features	Annual Savings
Manager AH	0.95% management fee and 22.25% performance allocation with the performance allocation aggregated over multiple portfolios	Greater of 0.65% management fee or 29% performance allocation	Performance Allocation netted across multiple portfolios	\$ 3,179,272
Manager AI	Multiple portfolios, each with 1% management fee and 20% performance allocation over varying index-based hurdles, some portfolios have catch up feature No aggregate performance allocation among the multiple portfolios	1% management fee and aggregate 17.50% performance allocation over index-based hard hurdle plus 350 basis points	Performance allocation netted across multiple portfolios with the opportunity to receive additional 10% discount off the management fee with AUM in excess of \$775M	\$ -
Manager AJ	1.25% management fee and 20% performance allocation	1.25% management fee and 30% performance allocation over index-based hard hurdle plus 350 basis points	Fees decline to 1% management fee and 30% performance allocation over index-based hard hurdle plus 350 basis points, effective 1/1/2020	\$ -
Manager AK	1% management fee and 15% performance allocation over index-based hard hurdle plus 150 basis points	0.65% management fee and 15% performance allocation over index-based hard hurdle plus 150 basis points		\$ 802,437
Manager AL	0.50% management fee and 20% performance allocation over 600 basis point preferred hurdle and 50/50 catch up	0.25% management fee and 25% performance allocation over 700 basis point preferred hurdle and 60/40 catch up		\$ 500,000
Manager AM	Greater of 1% of NAV plus Unfunded Commitment or 30% of the Revenue Shares	Greater of 0.50% of NAV plus Unfunded Commitment or 25% of the Revenue Shares		\$ 900,000
Manager AN	Invested in two share classes, each share class with a different fee structure - 1.25% management fee with 15% performance allocation over index-based hurdle plus 500 basis points and 1.50% management fee with 15% performance allocation over index-based hurdle plus 300 basis points dependent on share class	Invested in two share classes, each share class with a different fee structure - 1.25% management fee with 15% performance allocation over index-based hurdle plus 500 basis points and 1.50% management fee with 15% performance allocation over index-based hurdle plus 300 basis points dependent on share class		\$ -
Annualized Base Management Fee Savings				\$ 5,381,709
Compounded Savings over 30 Years Discounted at 7.25%				\$ 531,809,439

Total Expenses Breakdown

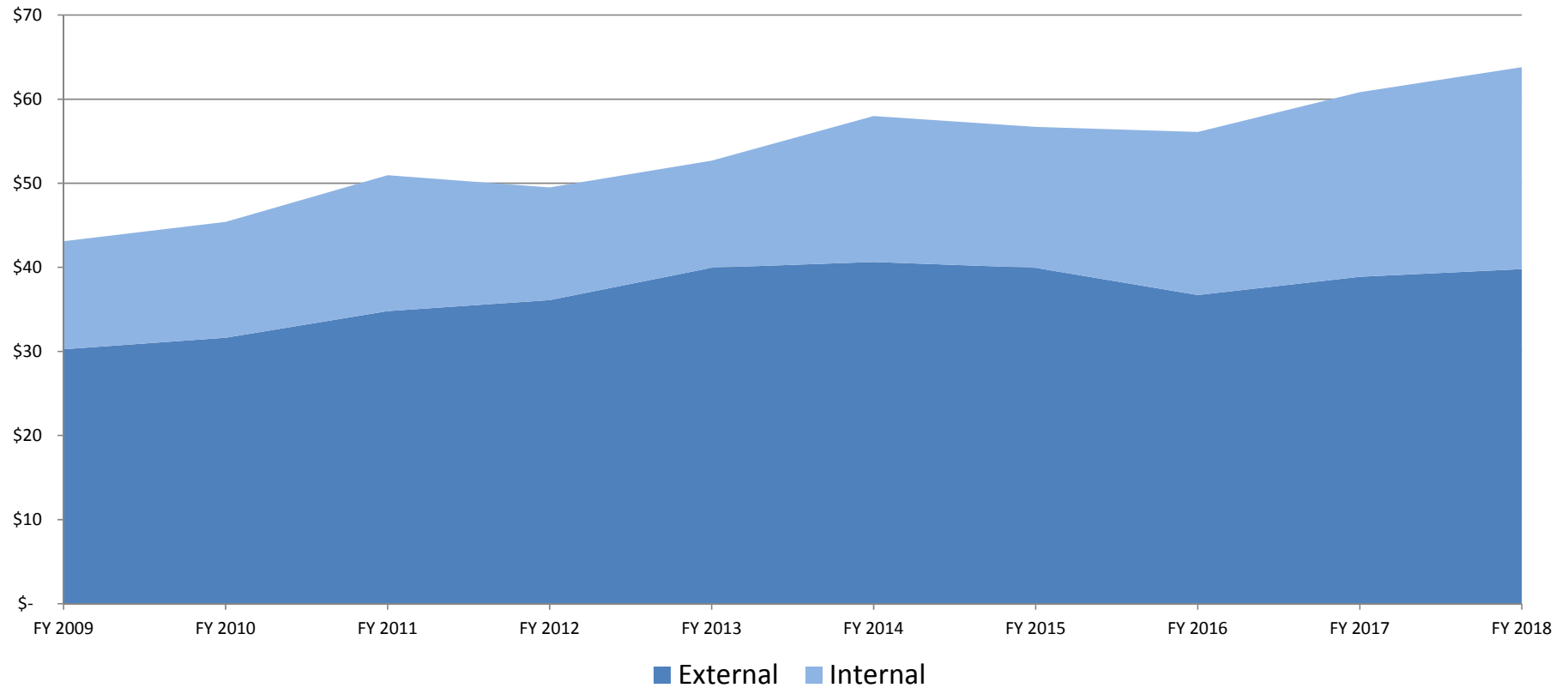


Why use External Managers?



External vs Internal

External AUM v Internal AUM (Gross Exposure)

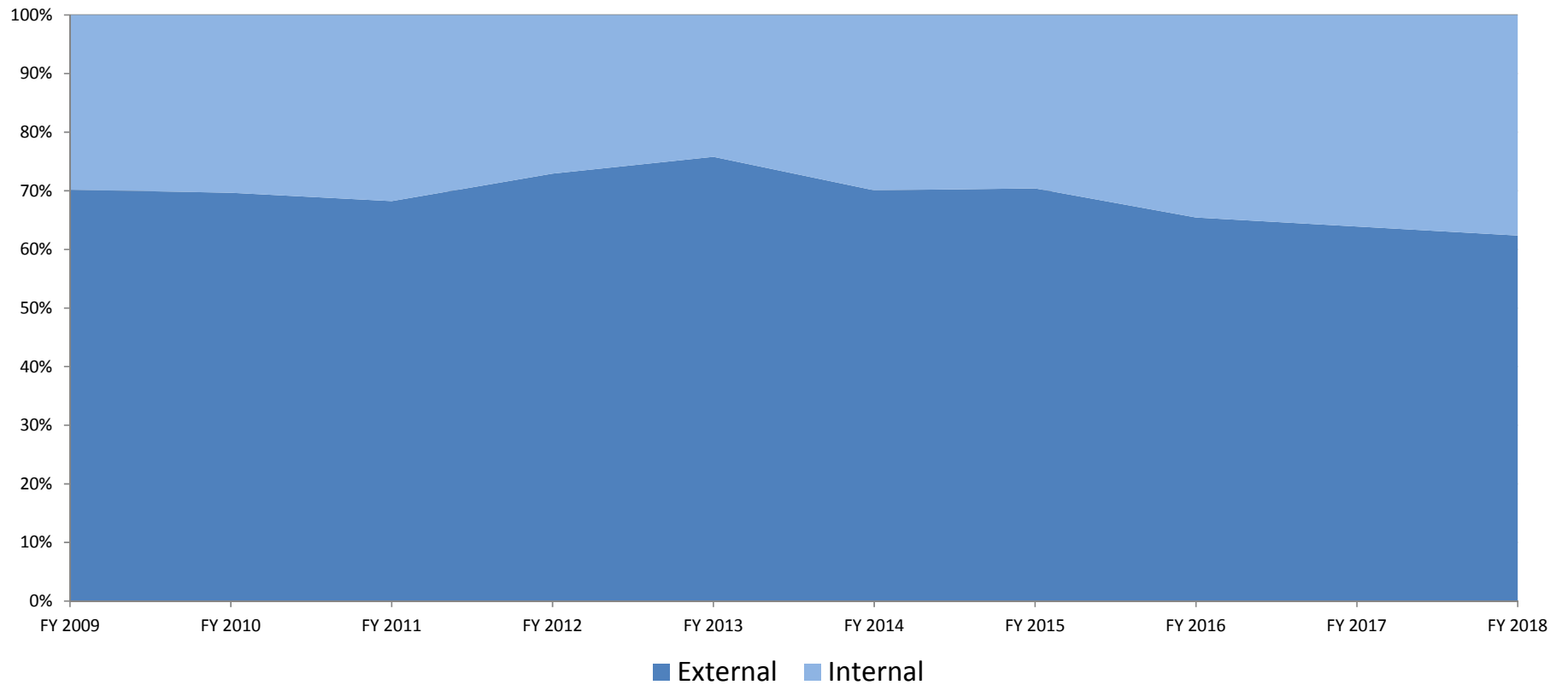


Amounts in billions of dollars
Calculated based upon monthly average gross exposure (NAV plus leverage)

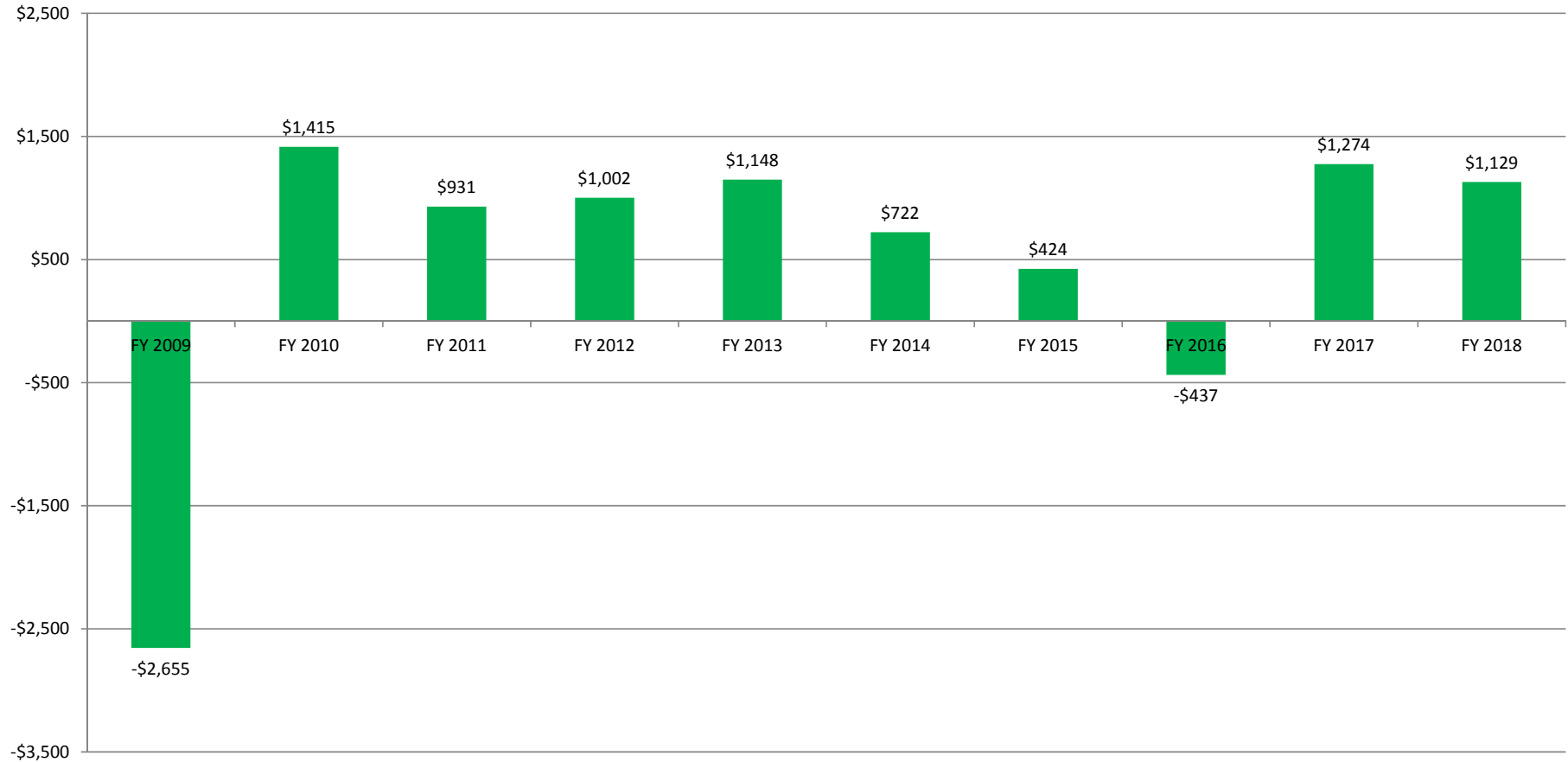


External vs Internal

External AUM v Internal AUM as a % of the Total Fund (Gross Exposure)



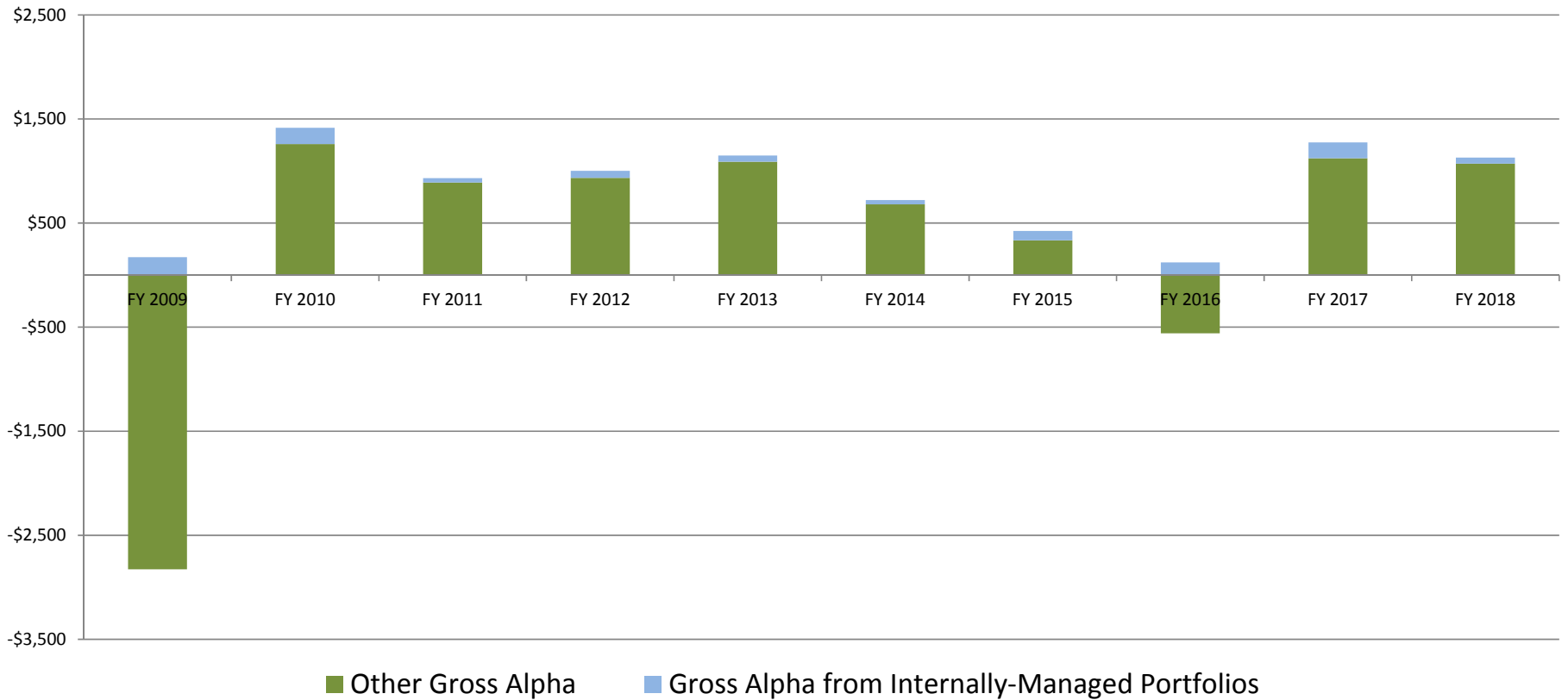
Total Gross Alpha



Gross Alpha is excess earnings over the earnings of the relevant benchmark index without regard for investment expenses
Dollar in millions



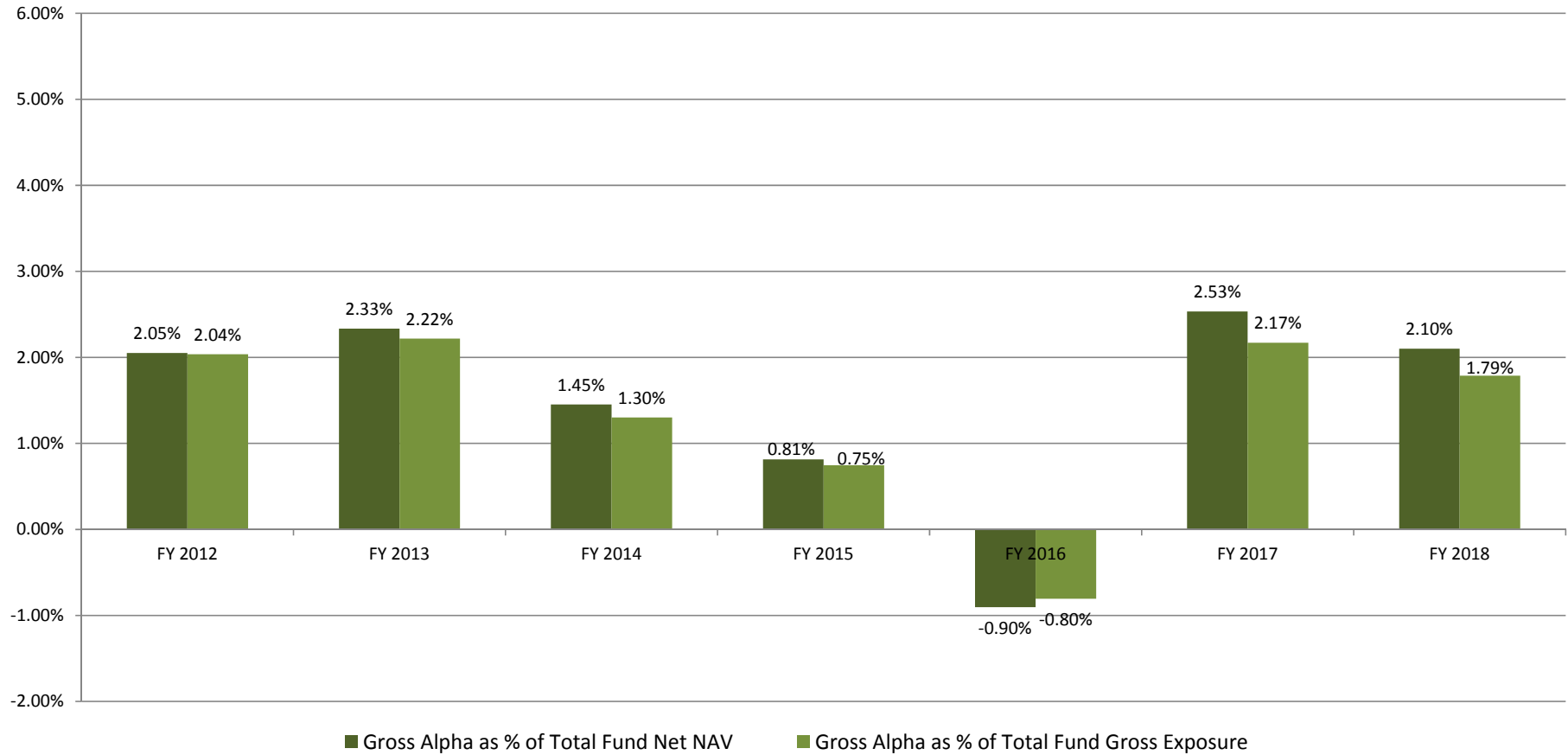
Total Gross Alpha



Gross Alpha is excess earnings over the earnings of the relevant benchmark index without regard for investment expenses
 Dollar in millions
 Does not include levered accounts



Total Gross Alpha



Gross Alpha is excess earnings over the earnings of the relevant benchmark index without regard for investment expenses
 Calculated based upon quarterly NAV and gross exposure (NAV plus leverage)



Net Alpha** Generated by External Managers

Manager	FY 2018 Return	FY 2018 Benchmark	1 Yr \$ Alpha	3 Year Return	3 Year Benchmark	3 Yr \$ Alpha	5 Year Return	5 Year Benchmark	5 Yr \$ Alpha
Aeolus Property Catastrophe Keystone PF Fund, LP	-19.45%	1.77%	\$ (35.9)	0.31%	1.09%	\$ 12.3	7.43%	0.75%	\$ 95.2
Apollo Aviation/SASOF III LP	9.49%	1.77%	\$ 7.9	9.92%	1.09%	\$ 17.3	N/A	N/A	N/A
Apollo Aviation/SASOF IV LP*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bridgewater Pure Alpha Fund II, Ltd.	11.11%	1.77%	\$ 80.8	2.04%	1.09%	\$ 29.2	6.63%	0.75%	\$ 276.7
Brigade Leveraged Capital Structures Offshore Fund, Ltd.	7.03%	1.77%	\$ 15.5	5.59%	1.09%	\$ 38.3	5.06%	0.75%	\$ 99.8
Capital Structure Investments Offshore Fund, Ltd.	4.57%	1.77%	\$ 8.0	6.00%	1.09%	\$ 39.2	2.76%	0.75%	\$ 28.0
Capula Global Relative Value Fund Limited	4.29%	1.77%	\$ 10.6	6.43%	1.09%	\$ 61.7	7.45%	0.75%	\$ 102.2
Capula Tail Risk Fund Limited	-3.70%	1.77%	\$ (17.8)	-2.42%	1.09%	\$ (34.9)	-2.40%	0.75%	\$ (53.1)
Caspian Keystone Focused Fund, Ltd.	3.39%	8.67%	\$ (0.8)	N/A	N/A	N/A	N/A	N/A	N/A
Caspian Select Credit International, Ltd.	4.36%	1.77%	\$ 6.3	2.33%	1.09%	\$ 9.3	2.67%	0.75%	\$ 22.6
DaVinci Reinsurance Ltd.	-17.12%	1.77%	\$ (4.2)	N/A	N/A	N/A	N/A	N/A	N/A
Garda Fixed Income Relative Value Opportunity Fund Ltd.	4.24%	1.77%	\$ 9.8	5.17%	1.09%	\$ 44.5	5.25%	0.75%	\$ 73.3
HS Group Sponsor Fund II, Ltd.*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nephila/Nimbus Weather Fund*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nephila/Palmetto Fund Ltd.	-6.49%	1.77%	\$ (14.4)	0.52%	1.09%	\$ 1.8	2.86%	0.75%	\$ 36.7
Oceanwood Opportunities Fund	5.55%	1.77%	\$ 8.7	3.86%	1.09%	\$ 19.0	N/A	N/A	N/A
OWS Credit Opportunity Offshore Fund III, Ltd.	13.52%	1.77%	\$ 27.9	N/A	N/A	N/A	N/A	N/A	N/A
Perry Partners LP	-1.12%	1.77%	\$ (1.1)	-4.54%	1.09%	\$ (26.6)	N/A	N/A	N/A
PIMCO Absolute Return Strategy V Offshore Fund, Ltd.	-0.18%	1.77%	\$ (5.2)	0.78%	1.09%	\$ (2.4)	5.09%	0.75%	\$ 55.2
PIMCO Global Credit Opportunity Offshore Fund, Ltd.	6.01%	1.77%	\$ 11.8	5.76%	1.09%	\$ 38.2	6.27%	0.75%	\$ 73.2
PIMCO Multi-Asset Volatility Onshore Fund, LLC	-1.57%	1.77%	\$ (7.9)	1.37%	1.09%	\$ 2.3	3.00%	0.75%	\$ 25.0
RenaissanceRe Medici Fund Ltd.	3.28%	1.77%	\$ 0.7	N/A	N/A	N/A	N/A	N/A	N/A
RenaissanceRe Upsilon Diversified Fund Ltd.	-57.78%	1.77%	\$ (12.3)	N/A	N/A	N/A	N/A	N/A	N/A
Two Sigma Risk Premia Enhanced Fund, LP	7.85%	1.77%	\$ 9.0	N/A	N/A	N/A	N/A	N/A	N/A
Venor Capital Offshore, Ltd.	13.92%	1.77%	\$ 18.5	N/A	N/A	N/A	N/A	N/A	N/A
Absolute Return Total			\$ 115.7			\$ 249.2			\$ 834.7

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Net Alpha** Generated by External Managers (Continued)

Manager	FY 2018 Return	FY 2018 Benchmark	1 Yr \$ Alpha	3 Year Return	3 Year Benchmark	3 Yr \$ Alpha	5 Year Return	5 Year Benchmark	5 Yr \$ Alpha
Gresham	13.01%	7.35%	\$ 17.9	-2.31%	-4.54%	\$ 23.1	-4.60%	-6.40%	\$ 35.3
PIMCO Commodity Alpha Fund	11.65%	1.77%	\$ 26.7	16.60%	1.09%	\$ 103.6	N/A	N/A	N/A
Wellington Management Company	13.57%	17.66%	\$ (16.9)	1.38%	2.32%	\$ (13.7)	-1.53%	-0.88%	\$ (16.9)
Commodities Total			\$ 27.6			\$ 113.0			\$ 18.4
Alliance Bernstein Global Fixed	2.37%	3.11%	\$ (1.3)	4.12%	3.58%	\$ 4.9	1.25%	0.94%	\$ 4.9
Apollo European Principal Fund II	8.25%	2.62%	\$ 10.2	11.58%	5.53%	\$ 24.8	10.58%	5.51%	\$ 33.0
Avenue Energy Opportunities Fund	10.88%	2.62%	\$ 19.3	4.68%	5.53%	\$ 24.9	N/A	N/A	N/A
Avenue Energy Opportunities Fund II*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avenue Europe SS III	9.10%	2.62%	\$ 10.0	N/A	N/A	N/A	N/A	N/A	N/A
Bain Capital Credit Managed Account (PSERS), L.P.	6.95%	2.62%	\$ 15.7	5.89%	5.53%	\$ (8.0)	5.58%	5.51%	\$ (11.1)
Bain Capital Credit Opp. Fund IV	75.59%	2.62%	\$ 45.0	22.12%	5.53%	\$ 36.0	13.58%	5.51%	\$ 21.1
Bain Capital Distressed and Special Situations 2013	17.52%	2.62%	\$ 44.4	6.15%	5.53%	\$ 13.5	7.71%	5.51%	\$ 29.0
Bain Capital Distressed and Special Situations 2016 (A), L.P.	14.84%	2.62%	\$ 16.3	N/A	N/A	N/A	N/A	N/A	N/A
Bain Capital Middle Market Credit 2010, L.P.	1.00%	2.62%	\$ (0.5)	-0.60%	5.53%	\$ (11.2)	2.94%	5.51%	\$ (1.8)
Bain Capital Middle Market Credit 2014, L.P.	11.69%	8.40%	\$ 5.4	5.46%	5.53%	\$ (4.9)	N/A	N/A	N/A
BlackRock Global Alpha	0.93%	-0.40%	\$ 12.4	4.58%	1.72%	\$ 75.2	4.18%	2.27%	\$ 79.6
Bridgewater TIPS (unlevered)	5.01%	3.90%	\$ 23.3	N/A	N/A	N/A	N/A	N/A	N/A
Brigade Distressed Value	7.03%	1.56%	\$ 8.3	8.12%	5.53%	\$ 20.1	8.27%	5.51%	\$ 29.7
Brigade Structured Credit Offshore Fund	6.80%	2.87%	\$ 9.8	9.19%	5.53%	\$ 23.7	N/A	N/A	N/A
Capula LIBOR Tail Risk	-3.69%	1.77%	\$ (2.6)	N/A	N/A	N/A	N/A	N/A	N/A
Carlyle Energy Mezz. Opp. Fund	-2.50%	2.62%	\$ (5.4)	-23.17%	5.53%	\$ (93.2)	-9.89%	5.51%	\$ (76.3)
Carlyle Energy Mezz. Opp. Fund II	7.43%	2.62%	\$ 0.9	N/A	N/A	N/A	N/A	N/A	N/A
Cerberus Levered Loan Fund I	6.02%	2.62%	\$ 0.3	4.57%	5.53%	\$ (2.1)	4.23%	5.51%	\$ (6.6)
Cerberus Levered Loan Fund II	1.79%	2.62%	\$ (1.1)	2.91%	5.53%	\$ (11.4)	7.00%	5.51%	\$ 11.2
Cerberus PSERS Levered Loan Opportunities Fund	13.34%	2.62%	\$ 19.9	N/A	N/A	N/A	N/A	N/A	N/A
Franklin Templeton Emerging Fixed Income	3.54%	-1.43%	\$ 16.7	5.42%	2.05%	\$ 30.3	4.19%	-0.06%	\$ 75.2
Galton Onshore Mortgage Recovery Fund III, LP	7.34%	2.62%	\$ 6.4	6.72%	5.53%	\$ 5.9	N/A	N/A	N/A
Galton Onshore Mortgage Recovery Fund IV, L.P.*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Net Alpha** Generated by External Managers (Continued)

Manager	FY 2018 Return	FY 2018 Benchmark	1 Yr \$ Alpha	3 Year Return	3 Year Benchmark	3 Yr \$ Alpha	5 Year Return	5 Year Benchmark	5 Yr \$ Alpha
Garda Fixed Income Relative Value Opportunity Fund (TIPS)	4.23%	1.56%	\$ 3.9	5.17%	0.00%	\$ 12.7	N/A	N/A	N/A
Garda Inflation Opp. Fund CI B (unlevered)	1.04%	2.11%	\$ (3.2)	1.47%	1.93%	\$ (2.8)	N/A	N/A	N/A
Hayfin SOF II USD Co-Invest	5.82%	2.62%	\$ 0.2	N/A	N/A	N/A	N/A	N/A	N/A
Hayfin SOF II USD LP	6.62%	2.62%	\$ 1.3	N/A	N/A	N/A	N/A	N/A	N/A
Hayfin Special Opportunities Credit LP	12.00%	2.62%	\$ 14.2	10.21%	5.53%	\$ 21.1	5.73%	5.51%	\$ 8.3
ICG Europe Fund V	15.92%	2.62%	\$ 20.9	11.11%	5.53%	\$ 34.7	10.35%	5.51%	\$ 33.3
ICG Europe Fund VI	26.99%	2.62%	\$ 13.8	N/A	N/A	N/A	N/A	N/A	N/A
Latitude Management Real Estate Capital IV	2.19%	2.62%	\$ (0.0)	N/A	N/A	N/A	N/A	N/A	N/A
LBC Credit Partners II	22.92%	2.62%	\$ 6.7	18.99%	5.53%	\$ 14.1	19.63%	5.51%	\$ 49.0
LBC Credit Partners III	3.93%	2.62%	\$ 1.6	7.68%	5.53%	\$ 4.6	9.62%	5.51%	\$ 18.9
LBC-P Credit Fund LP	13.84%	2.62%	\$ 12.5	N/A	N/A	N/A	N/A	N/A	N/A
Mariner International Infrastructure	5.46%	2.62%	\$ 4.1	8.01%	5.53%	\$ 6.8	N/A	N/A	N/A
Mariner/Galton RMBS	3.17%	0.15%	\$ 5.5	3.72%	1.46%	\$ 12.0	5.50%	2.92%	\$ 20.5
Oaktree Loan Fund 2X, LP	3.10%	2.62%	\$ 0.1	-5.37%	5.53%	\$ (4.0)	-3.18%	5.51%	\$ (4.9)
Park Square Credit Opportunities	1.53%	2.62%	\$ (1.6)	N/A	N/A	N/A	N/A	N/A	N/A
Penn Mutual Asset Management	2.52%	1.77%	\$ 0.8	N/A	N/A	N/A	N/A	N/A	N/A
PIMCO BRAVO Fund III Onshore Feeder, L.P.*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIMCO Multi-Sector Strategy	1.39%	1.23%	\$ 0.7	2.77%	2.56%	\$ (9.3)	2.92%	2.92%	\$ (15.1)
Pugh Capital Management	-0.38%	-0.40%	\$ 0.0	1.83%	1.72%	\$ 0.3	2.43%	2.27%	\$ 0.7
Radcliffe Ultra Short Duration	2.38%	1.77%	\$ 1.6	2.94%	1.09%	\$ 14.3	2.74%	0.75%	\$ 23.9
SEI Investment Management	5.03%	0.68%	\$ 4.9	4.67%	1.47%	\$ 10.4	N/A	N/A	N/A
Summit Partners Credit Fund II LP	8.55%	2.62%	\$ 6.3	8.30%	5.53%	\$ 8.6	N/A	N/A	N/A
The Varde Scratch and Dent Fund Feed I-A	7.85%	2.62%	\$ 2.4	N/A	N/A	N/A	N/A	N/A	N/A
The Varde Scratch and Dent Fund, LP	6.56%	2.62%	\$ 5.8	7.17%	5.53%	\$ 0.9	N/A	N/A	N/A
TOP NPL (A)	3.04%	2.62%	\$ 0.1	4.30%	5.53%	\$ 7.0	12.41%	5.51%	\$ 38.5
TPG Opportunities Partners II, LP	19.41%	2.62%	\$ 5.2	13.26%	5.53%	\$ 13.3	14.95%	5.51%	\$ 33.7
TPG Opportunities Partners III, LP	18.07%	2.62%	\$ 12.6	14.87%	5.53%	\$ 16.1	N/A	N/A	N/A
TPG TAO	8.28%	2.62%	\$ 15.0	8.92%	5.53%	\$ 17.0	N/A	N/A	N/A
Fixed Income Total			\$ 388.6			\$ 306.1			\$ 394.7

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Net Alpha** Generated by External Managers (Continued)

Manager	FY 2018 Return	FY 2018 Benchmark	1 Yr \$ Alpha	3 Year Return	3 Year Benchmark	3 Yr \$ Alpha	5 Year Return	5 Year Benchmark	5 Yr \$ Alpha
Acadian Asset Mgmt	13.14%	10.57%	\$ 6.1	12.48%	7.94%	\$ 27.9	12.25%	8.98%	\$ 33.1
Baillie Gifford	9.84%	7.28%	\$ 27.2	8.76%	5.07%	\$ 104.2	9.22%	5.99%	\$ 129.6
BlackRock EMAA	12.54%	8.20%	\$ 17.9	8.18%	5.60%	\$ 37.3	N/A	N/A	N/A
BlackRock Global Composite	12.43%	7.28%	\$ 29.1	5.78%	5.07%	\$ 16.2	7.58%	5.99%	\$ 43.5
Insight Everest - Int'l Eq (notional)	1.25%	1.24%	\$ 0.5	1.28%	1.37%	\$ (14.4)	3.19%	3.37%	\$ (23.8)
Insight Nevada - Infra (notional)	1.46%	1.49%	\$ (0.2)	N/A	N/A	N/A	N/A	N/A	N/A
Insight Oxygen - HY (notional)	-0.07%	-0.58%	\$ 1.9	0.00%	-0.39%	\$ 4.5	N/A	N/A	N/A
Insight Sierra - REIT (notional)	1.14%	1.22%	\$ (0.3)	N/A	N/A	N/A	N/A	N/A	N/A
Insight Wilson - PE (notional)	0.20%	0.15%	\$ 0.1	N/A	N/A	N/A	N/A	N/A	N/A
Marathon Asset Mgmt	7.29%	7.28%	\$ 0.1	6.10%	5.07%	\$ 25.4	7.38%	5.99%	\$ 46.7
Oberweis Asset Mgmt	18.50%	10.57%	\$ 14.7	11.85%	7.94%	\$ 19.2	14.73%	8.98%	\$ 42.2
QS Investors	9.53%	10.57%	\$ (0.9)	7.44%	7.94%	\$ (1.1)	10.06%	8.98%	\$ 4.1
The Children's Investment Fund, LP*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wasatch EM Small Cap	7.32%	5.34%	\$ 6.0	3.19%	5.60%	\$ 2.9	2.87%	4.18%	\$ (22.1)
Wasatch Int'l Small Cap	19.25%	10.57%	\$ 22.2	10.05%	7.94%	\$ 14.9	10.20%	8.98%	\$ 13.6
International Equity Total			\$ 124.5			\$ 237.1			\$ 266.8
Atlantic Trust	0.56%	-1.76%	\$ 13.2	-4.69%	-6.32%	\$ 26.7	1.14%	-3.03%	\$ 110.7
PSERS Harvest Funds MLP	0.41%	-1.76%	\$ 16.3	-5.00%	-6.32%	\$ 28.1	0.77%	-3.03%	\$ 136.4
Salient	-0.48%	-1.76%	\$ 7.6	-6.66%	-6.32%	\$ 0.9	0.14%	-3.03%	\$ 109.2
MLP Total			\$ 37.1			\$ 55.7			\$ 356.3
Security Capital Preferred Growth	10.31%	4.00%	\$ 11.5	9.03%	7.82%	\$ 3.6	7.10%	8.53%	\$ (18.0)
REIT Total			\$ 11.5			\$ 3.6			\$ (18.0)
BlackRock Market Advantage II (vol adjusted)	11.99%	6.11%	\$ 32.5	7.27%	N/A	\$ 52.7	N/A	N/A	N/A
Bridgewater All Weather (vol adjusted)	10.65%	6.11%	\$ 28.5	4.97%	N/A	\$ (67.1)	6.05%	N/A	N/A
Bridgewater Optimal (vol adjusted)	2.67%	6.11%	\$ (17.8)	N/A	N/A	N/A	N/A	N/A	N/A
DE Shaw Orienteer HV (vol adjusted)	6.69%	6.11%	\$ 4.6	N/A	N/A	N/A	N/A	N/A	N/A
Risk Parity Total			\$ 47.7			\$ (14.4)			\$ -
Radcliffe Specialty Finance Debt	2.50%	2.38%	\$ 0.4	4.05%	1.69%	\$ 22.4	N/A	N/A	N/A
U.S Equity Total			\$ 0.4			\$ 22.4			\$ -

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Net Alpha** Generated by External Managers (Continued)

Investment	ITD Direct Alpha	ITD KS PME
GCM Grosvenor Customized Infrastructure Strategies II, LP	21.19	1.13
International Infrastructure Finance Company II, L.P.	13.24	1.11
Strategic Partners Real Assets II, L.P.	28.45	1.27
Actis Emerging Markets 3, L.P.	(9.89)	0.66
Actis Global 4, L.P.	(6.68)	0.85
Apax Digital, L.P.	N/A	N/A
Apax Europe VII, L.P.	(3.49)	0.84
Bain Capital Asia Fund II, L.P.	14.32	1.51
Bain Capital Asia Fund III, L.P.	56.52	1.22
Bain Capital Fund XI, L.P.	16.53	1.31
Bain Capital Fund XII, L.P.	(84.53)	0.15
Baring Asia Private Equity Fund III, L.P.	42.30	1.95
Baring Asia Private Equity Fund IV, L.P.	1.02	1.05
Baring Asia Private Equity Fund V, L.P.	(0.33)	0.99
Baring Asia Private Equity Fund VI, L.P.	1.19	1.02
Blue Point Capital Partners (B), L.P.	(0.40)	0.98
Blue Point Capital Partners II (B), L.P.	12.81	1.63
Blue Point Capital Partners III (B), L.P.	9.53	1.14
Blue Point Capital Partners IV, L.P.	N/A	N/A
Bridgepoint Capital II (Secondary)	18.67	1.87
Bridgepoint Development Capital III, L.P.	38.31	1.38
Bridgepoint Europe I	10.51	1.57
Bridgepoint Europe II	15.15	1.25
Bridgepoint Europe III A, L.P.	(2.29)	0.85
Bridgepoint Europe IV, L.P.	(2.34)	0.91
Bridgepoint Europe V, L.P.	4.46	1.05
Capital International Private Equity Fund V L.P.	(8.48)	0.79
Capital International Private Equity Fund VI, L.P.	(11.15)	0.71
Catterton Growth Partners II, L.P.	(4.18)	0.87

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Net Alpha** Generated by External Managers (Continued)

Investment	ITD Direct Alpha	ITD KS PME
Catterton Growth Partners III, L.P., L	9.19	1.09
Catterton Growth Partners, L.P.	(0.75)	0.97
Catterton Partners V, L.P.	(1.37)	0.93
Catterton Partners VI, L.P.	4.76	1.26
Catterton Partners VII, L.P.	2.20	1.06
Catterton VIII, L.P., L	(18.59)	0.88
Cinven Fund (Fifth), L.P.	11.27	1.30
Cinven Fund (Fourth), L.P.	1.35	1.07
Cinven Fund (Sixth), L.P.	(31.76)	0.84
Coller International Partners VI, L.P.	4.36	1.14
Coller International Partners VII, L.P.	23.14	1.17
Crestview Partners II, L.P.	2.93	1.12
Crestview Partners III, L.P.	(3.35)	0.93
Crestview Partners, L.P.	2.07	1.13
CVC Capital Partners Asia Pacific III, L.P.	3.88	1.14
CVC European Equity Partners V (A), L.P.	4.97	1.19
DCPF VI Oil and Gas Co-Investment Fund, L.P.	7.83	1.17
Denham Commodity Partners Fund VI, L.P.	(2.71)	0.94
Energy & Minerals Group Fund III, L.P., The	(11.58)	0.71
Equistone Partners Europe Fund V E, L.P.	0.62	1.01
Equistone Partners Europe Fund VI E, SCSp	N/A	N/A
Evergreen Pacific Partners II, L.P.	10.33	1.38
Evergreen Pacific Partners, L.P.	N/A	N/A
First Reserve Fund XII, L.P.	(18.91)	0.45
GoldPoint Partners Co-Investment V, L.P.	8.88	1.17
HgCapital 7 A, L.P.	4.01	1.09
HgCapital 8 D, L.P.	N/A	N/A
HGGC Fund II, L.P.	2.86	1.05
HGGC Fund III, L.P.	5.47	1.05
Incline Equity Partners III (PSERS), L.P.	14.88	1.28

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Net Alpha** Generated by External Managers (Continued)

Investment	ITD Direct Alpha	ITD KS PME
Incline Equity Partners IV, L.P.	(51.09)	0.77
Irving Place Capital MB-PSERS II, L.P.	4.75	1.21
Irving Place Capital Partners III SPV, L.P.	(1.89)	0.90
Landmark Equity Partners XIII, L.P.	(0.33)	0.99
Landmark Equity Partners XIV, L.P.	(1.82)	0.95
Lindsay Goldberg & Bessemer L.P.	22.41	1.75
Milestone Partners III, L.P.	(9.74)	0.60
Milestone Partners IV, L.P.	2.02	1.08
New Mountain Partners III L.P.	2.69	1.12
New Mountain Partners IV, L.P.	9.85	1.18
New Mountain Partners V, L.P.	(6.95)	0.96
New Mountain Partners, L.P., Allegheny	10.12	1.62
New York Life Capital Partners I, L.P.	3.46	1.15
New York Life Capital Partners II, L.P.	17.91	1.66
New York Life Capital Partners III-A, L.P.	(5.13)	0.74
New York Life Capital Partners IV-A, L.P.	2.86	1.14
NGP Natural Resources X, L.P.	(3.64)	0.90
NGP Natural Resources XI, L.P.	8.49	1.10
North Haven Private Equity Asia IV, L.P.	(1.41)	0.97
Odyssey Investment Partners Fund V, L.P.	(23.62)	0.69
Orchid Asia V, L.P.	14.57	1.35
Orchid Asia VI, L.P.	(4.06)	0.96
Orchid Asia VII, L.P.	N/A	N/A
PAI Europe IV-B2, L.P.	4.21	1.15
PAI Europe V, L.P.	(0.81)	0.96
PAI Europe VI, L.P.	6.05	1.10
PAI Europe VII, L.P.	N/A	N/A
Palladium Equity Partners II-A, L.P.	2.20	1.18
Palladium Equity Partners IV, L.P.	5.00	1.09
Partners Group Secondary 2008, L.P.	(2.32)	0.91

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Net Alpha** Generated by External Managers (Continued)

Investment	ITD Direct Alpha	ITD KS PME
Partners Group Secondary 2011 (USD), L.P. Inc.	6.65	1.21
Partners Group Secondary 2015 (USD) A, L.P.	5.78	1.07
Permira IV, L.P.	1.08	1.06
Platinum Equity Capital Partners IV, L.P.	(5.47)	0.98
Platinum Equity Capital Partners-A II, L.P.	4.94	1.10
Platinum Equity Capital Partners-A III, L.P.	16.13	1.23
Platinum Equity Capital Partners-A, L.P.	43.81	1.67
PNC Equity Partners II, L.P.	4.54	1.22
Portfolio Advisors Secondary Fund III, L.P.	N/A	N/A
StepStone International Investors III L.P.	(8.46)	0.68
Sterling Capital Partners, L.P.	9.07	1.45
Strategic Partners Fund II, L.P.	19.14	1.32
Strategic Partners Fund III-B, L.P.	0.41	1.02
Strategic Partners Fund IV, L.P.	3.20	1.11
Strategic Partners Fund V, L.P.	7.15	1.20
Strategic Partners Fund VI, L.P.	11.05	1.21
Strategic Partners Fund VII, L.P.	66.61	1.30
Trilantic Capital Partners IV L.P.	4.51	1.14
Trilantic Capital Partners V (North America), L.P.	5.74	1.10
U.S. Equity Partners II	6.43	1.16
AG Core Plus Realty Fund III, L.P.	11.42	1.33
AG Core Plus Realty Fund IV, L.P.	6.05	1.10
AG Europe Realty Fund II, L.P.	N/A	N/A
Almanac Realty Securities V, L.P.	1.27	1.04
Almanac Realty Securities VI, L.P.	3.96	1.10
Almanac Realty Securities VII, L.P.	12.02	1.16
Almanac Realty Securities VIII, L.P.	N/A	N/A
Apollo Real Estate Finance Corp	(10.51)	0.57
Ares European Real Estate Fund III, L.P.	(9.00)	0.68
Ares European Real Estate Fund IV, L.P.	12.45	1.16
Ares U.S. Real Estate Fund IX, L.P.	N/A	N/A

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Net Alpha** Generated by External Managers (Continued)

Investment	ITD Direct Alpha	ITD KS PME
Ares U.S. Real Estate Fund VII, L.P.	2.06	1.07
Ares U.S. Real Estate Fund VIII, L.P.	13.31	1.19
Avenue Real Estate Fund (Parallel) L.P.	(6.71)	0.58
Bell Institutional Fund IV, LLC	8.39	1.38
Bell Institutional Fund V, L.P.	9.24	1.22
Bell Institutional Fund VI, L.P.	5.10	1.02
BlackRock Asia Property Fund III, L.P.	(11.61)	0.47
BlackRock Europe Property Fund III, L.P.	(8.55)	0.66
Blackstone Real Estate Debt Strategies II, L.P.	0.69	1.01
Blackstone Real Estate Debt Strategies III, L.P.	22.84	1.14
Blackstone Real Estate Partners Europe III, L.P.	2.50	1.10
Blackstone Real Estate Partners Europe IV, L.P.	11.21	1.31
Blackstone Real Estate Partners V, L.P.	4.93	1.30
Blackstone Real Estate Partners VI, L.P.	5.14	1.27
Blackstone Real Estate Partners VII, L.P.	8.63	1.26
Blackstone Real Estate Partners VIII, L.P.	14.71	1.22
BPG/PSERS Co-Investment Fund	4.54	1.14
Brookfield Strategic Real Estate Partners II, L.P.	15.91	1.21
Brookfield Strategic Real Estate Partners, L.P.	12.86	1.45
Cabot Industrial Core Fund, L.P.	18.45	1.23
Cabot Industrial Value Fund IV, L.P.	26.19	1.59
Cabot Industrial Value Fund V, L.P.	33.97	1.16
Carlyle Realty Partners III, L.P.	12.36	1.41
Carlyle Realty Partners IV, L.P.	(4.74)	0.74
Carlyle Realty Partners V, L.P.	(1.35)	0.95
Carlyle Realty Partners VI, L.P.	9.94	1.26
Carlyle Realty Partners VII, L.P.	11.67	1.20
Carlyle Realty Partners VIII, L.P.	(100.00)	-
Centerline High Yield CMBS III - Loan/Stock	(21.07)	0.54
DRA Growth and Income Fund IX, LLC	26.40	1.16

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Net Alpha** Generated by External Managers (Continued)

Investment	ITD Direct Alpha	ITD KS PME
DRA Growth and Income Fund VI, L.P.	0.08	1.00
DRA Growth and Income Fund VII, L.P.	9.86	1.41
DRA Growth and Income Fund VIII, LLC	8.92	1.17
Exeter Core Industrial Club Fund II, L.P.	17.41	1.18
Exeter Industrial Value Fund II, L.P.	17.36	1.53
Exeter Industrial Value Fund III, L.P.	27.92	1.73
Exeter Industrial Value Fund IV, L.P.	19.15	1.13
Fortress Investment Fund IV LP	(5.01)	0.68
Fortress Investment Fund LLC	7.12	1.27
Fortress Investment Fund V (Fund A) L.P.	(4.00)	0.72
JPMCB Strategic Property Fund	(0.14)	0.99
LAI Strategic Realty Investors, L.P.	3.02	1.14
Latitude Management Real Estate Capital III, Inc.	2.82	1.10
Legg Mason Real Estate Capital II	(2.81)	0.86
LEM Multifamily Senior Equity Fund IV, L.P.	25.87	1.37
LEM RE HY Debt & Pfd Equity Fund III, L.P.	16.15	1.52
LEM Real Estate Mezzanine Fund II, L.P.	(7.00)	0.75
Paramount Group Real Estate Fund VII, L.P.	(1.30)	0.98
Peabody Global Real Estate Partners	(3.02)	0.91
Pramerica Real Estate Capital VI, L.P.	13.66	1.10
PRISA	0.28	1.03
PSERS YES Holdings, L.P.	30.04	1.48
RCG Longview Debt Fund IV, L.P.	(5.47)	0.87
RCG Longview Debt Fund V, L.P.	3.28	1.08
RCG Longview Debt Fund VI, L.P.	25.86	1.12
RCG Longview Equity Fund, L.P.	(9.72)	0.56
Senior Housing Partnership Fund IV, L.P.	7.33	1.30
Senior Housing Partnership Fund V, L.P.	12.80	1.22
Silverpeak Legacy/PSERS, L.P.	(2.00)	0.96
Stockbridge Real Estate Fund II, LP	(16.63)	0.20

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Net Alpha** Generated by External Managers (Continued)

Investment	ITD Direct Alpha	ITD KS PME
Stockbridge Real Estate Fund III, LP	(9.21)	0.52
Stockbridge Real Estate Fund, L.P.	5.94	1.20
Strategic Partners Fund III RE, L.P.	(15.28)	0.35
Strategic Partners Fund IV RE, L.P.	(10.58)	0.52
UBS (US) Trumbull Property Fund, L.P.	0.61	1.06
812 Market Street	5.87	1.06
Atlanta Marriott	(6.77)	0.51
Big Valley Ranch	4.96	1.05
Five North 5th Street	(5.18)	0.50
Galleria at Ft Lauderdale, The	2.28	1.14
Lorida Groves	12.89	1.18
Maricopa Citrus	14.56	2.41
Oxteam Orchards	(7.81)	0.30
Rivercenter Mall	(1.47)	0.91
Townsend Grove	0.82	1.09
Apollo Investment Fund IX, L.P.	N/A	N/A
Apollo Investment Fund VIII, L.P.	3.91	1.07
Avenue Asia Special Situations Fund IV, LP	(4.84)	0.82
Avenue Special Situations Fund IV, L.P.	5.07	1.17
Avenue Special Situations Fund VI, L.P.	(9.23)	0.67
Cerberus Institutional Partners V, L.P.	1.22	1.04
Cerberus Institutional Partners VI, L.P.	(9.05)	0.93
Cerberus Institutional Partners, L.P. (Series 2)	15.12	1.71
Cerberus Institutional Partners, L.P. (Series 3)	5.43	1.30
Cerberus Institutional Partners, L.P. (Series 4)	1.24	1.08
Clearlake Capital Partners IV, L.P.	17.39	1.23
Clearlake Capital Partners V, L.P.	(4.92)	0.99
Gleacher Mezzanine Fund II, L.P.	0.60	1.01
Gold Hill Venture Lending 03-A, L.P.	5.91	1.30
GSC Recovery II, L.P.	2.93	1.13

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Net Alpha** Generated by External Managers (Continued)

Investment	ITD Direct Alpha	ITD KS PME
GSC Recovery III (Parallel Fund), L.P.	1.37	1.05
NYLIM Mezzanine Partners (Parallel Fund) L.P.	0.64	1.02
NYLIM Mezzanine Partners II (Parallel Fund) LP	4.65	1.14
OCM Opportunities Fund VII L.P.	6.60	1.30
OCM Opportunities Fund VII-b L.P.	3.77	1.14
Searchlight Capital II, L.P.	9.74	1.12
Venor Special Situations Fund II, L.P.	(4.25)	0.92
Versa Capital Fund I, L.P.	(2.75)	0.90
Versa Capital Fund II, L.P.	(9.82)	0.67
Versa Capital Fund III, L.P.	(35.65)	0.58
Windjammer Senior Equity Fund III, L.P.	12.11	1.57
Windjammer Senior Equity Fund IV, L.P.	(2.27)	0.95
Adams Capital Management, L.P.	26.38	1.49
Aisling Capital II L.P.	(6.63)	0.72
Aisling Capital III, L.P.	10.28	1.34
Aisling Capital IV, L.P.	10.12	1.08
Co-Investment 2000 Fund, L.P.	0.33	1.02
Co-Investment Fund II, L.P.	(7.82)	0.56
Cross Atlantic Technology Fund II	(7.09)	0.64
Cross Atlantic Technology Fund, L.P.	(1.58)	0.89
Insight Venture Partners X, L.P.	N/A	N/A
KBL Partnership, L.P.	(12.77)	0.48
Landmark Equity Partners V, L.P.	N/A	N/A
LLR Equity Partners II, L.P.	7.10	1.38
LLR Equity Partners III, L.P.	3.59	1.14
LLR Equity Partners IV, L.P.	12.08	1.27
LLR Equity Partners V, L.P.	(22.79)	0.78
NEPA Venture Fund II	N/A	N/A

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Net Alpha** Generated by External Managers (Continued)

Investment	ITD Direct Alpha	ITD KS PME
Perseus-Soros BioPharmaceutical Fund	9.30	1.26
Psilos Group Partners III-C, L.P.	(3.99)	0.81
Quaker Bio-Ventures, L.P.	(19.53)	0.28
Quaker BioVentures II, L.P.	(7.99)	0.72
SCP Private Equity Partners I, L.P.	N/A	N/A
SCP Private Equity Partners II, L.P.	(15.69)	0.23
StarVest Partners , L.P.	1.85	1.11
StarVest Partners II (Parallel), L.P.	(11.15)	0.57
Sterling Venture Partners, L.P.	(6.48)	0.71
Strategic Partners Fund III VC, L.P.	2.04	1.08
Strategic Partners Fund IV VC, L.P.	(3.65)	0.86
Summit Partners Growth Equity Fund IX, L.P.	43.18	1.17
Summit Partners Growth Equity Fund VIII, L.P.	13.05	1.40
Summit Partners Venture Capital Fund III, L.P.	7.48	1.31
Summit Partners Venture Capital Fund IV, L.P.	14.46	1.16
TDH III, L.P.	N/A	N/A
Tenaya Capital IV-P, L.P.	2.06	1.14
Tenaya Capital V-P, L.P.	8.56	1.40
Tenaya Capital VI, L.P.	(9.01)	0.69
Tenaya Capital VII, L.P.	(7.77)	0.89

Dollar amounts in millions

*New manager in FY2018 alpha not included

**Net Alpha refers to performance over the benchmark net of fees

Alpha Generated by Internal Managers

Manager	FY 2018 Return	FY 2018 Benchmark	1 Yr \$ Alpha	3 Year Return	3 Year Benchmark	3 Yr \$ Alpha	5 Year Return	5 Year Benchmark	5 Yr \$ Alpha
PSERS-S&P 400 Index Composite	13.64%	13.50%	\$ 0.6	11.16%	10.89%	\$ 3.0	12.84%	12.69%	\$ 3.0
PSERS-S&P 500 Index Composite	12.88%	14.37%	\$ (39.0)	11.95%	11.93%	\$ (3.0)	13.49%	13.42%	\$ 7.0
PSERS-S&P 600 Index Composite	21.16%	20.50%	\$ 3.0	14.42%	13.84%	\$ 7.0	15.32%	14.60%	\$ 12.0
PSERS Active Core Plus Fixed Income	0.66%	-0.40%	\$ 13.0	2.79%	1.72%	\$ 38.0	3.18%	2.27%	\$ 52.0
PSERS Total TIPS	2.85%	2.11%	\$ 9.0	2.54%	1.93%	\$ 19.0	2.25%	1.68%	\$ 33.0
PSERS ACWI x US Index Fund	8.48%	7.28%	\$ 36.0	5.86%	5.07%	\$ 70.0	6.66%	5.99%	\$ 86.0
PSERS MLP	0.60%	0.18%	\$ 2.0	N/A	N/A	N/A	N/A	N/A	N/A
Internally Managed Private Debt Co-Investment	-0.20%	2.62%	\$ (0.4)	-25.57%	5.53%	\$ (21.7)	N/A	N/A	N/A
Internally Managed Private Equity	13.36%	15.87%	\$ (11.8)	21.66%	11.47%	\$ 114.0	27.83%	12.41%	\$ 170.0
Internally Managed Private Real Estate	15.86%	13.62%	\$ 2.7	17.42%	10.07%	\$ 25.9	22.83%	11.43%	\$ 29.0
PSERS Risk Parity (vol adjusted)	6.63%	6.11%	\$ 14.0	5.82%	5.68%	\$ 30.0	6.95%	6.40%	\$ 40.0
PSERS Ultra Short Duration	1.54%	1.30%	\$ 13.0	0.89%	0.62%	\$ 39.0	0.63%	3.80%	\$ 50.0

Dollar amounts in millions
Does not include levered accounts

Breakdown of Internal and Other Expenses

FY 2018			
Other Expenses		Internal Management Expenses	
Investment Consultants		Staff Compensation (salary and benefits)	\$10,421,547
Aksia, LLC	\$525,000		
Courtland Partners LTD	\$435,042	Specialized Service Providers	
Glass Lewis & Co. LLC	\$134,011	BlackRock Solutions (Risk)	\$1,011,667
Hamilton Lane Advisors LLC	\$770,000	Bloomberg	\$1,161,228
Hewitt EnnisKnupp Inc	\$715,525	Cornerstone Macro	\$150,000
Portfolio Advisors	\$1,025,000	Misc Service Providers	\$174,429
STP Investment Services LLC (ABOR)	\$206,239		
Misc Consultants	\$122,613		
Misc. Legal Fees	\$8,961	Overhead	\$669,540
BNY Mellon (Custody)	\$2,267,797	GASB 68 Pension Expense	\$885,069
Total Other Expense	\$6,210,188	Total Internal Management Expenses	\$14,473,480

Key Takeaways

1. Internal Management

- Utilize where we have the internal capability and capacity
- Internal PMs benefit from having External Managers

2. External Management

- Seek to negotiate Base Management Fee lower as % of AUM
- Accept that Profit Sharing Fees will be highly variable
- Accept that Profit Sharing Fees will increase when Alpha increases

3. Benefits vs Costs

- For every \$1 of Total Expenses paid for FY 2018, we earned \$2.41 in Gross Alpha



COMMONWEALTH OF PENNSYLVANIA
PUBLIC SCHOOL EMPLOYEES' RETIREMENT SYSTEM

Investment Fee Report FY 2018

John B. Kemp, CTP - Managing Director, Investment Operations and Risk
Raymond J. Schleinkofer, CFA - Senior Portfolio Manager, Traditional Investment Strategies
Darren C. Foreman, CAIA - Senior Portfolio Manager, Non-Traditional Investment Strategies

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