

Arizona State Retirement System

Independent ASRS Investment Program Oversight for the Period Ending December 31, 2017

February 23, 2017

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ASRS INVESTMENT OBJECTIVES/PERFORMANCE

Note: All of the data shown on the following pages is as of December 31, 2017 and reflects the deduction of investment manager fees, unless otherwise noted.

ASRS INVESTMENT OBJECTIVES

Macro

- Objective #1: Achieve a twenty-year rolling annual total fund net rate of return equal to or greater than the actuarial assumed interest rate.
- Objective #2: Achieve one- and three-year rolling annual total fund net rates of return equal to or greater than the return of the ASRS Strategic Asset Allocation Policy (SAAP) Benchmark.
- Objective #3: Achieve one- and three-year rolling annual net rates of return for ASRS strategic asset classes that are equal to or greater than their respective strategic asset class benchmarks.
- Objective #4: Ensure sufficient monies are available to meet pension benefits, health insurance, member refunds, administrative payments, and other cash flow requirements.

Micro



Source: ASRS Strategic Plan, March 2013

TOTAL FUND PERFORMANCE

- Objective #1: Achieve a twenty-year rolling annual total fund net rate of return equal to or greater than the actuarial assumed interest rate.

	20 Year Annualized Return
Total Fund	6.9%
Constant 8%	7.5%
Excess Return	(0.6)%

Goal Met:
No



TOTAL FUND PERFORMANCE

- Objective #2: Achieve one- and three-year rolling annual total fund net rates of return equal to or greater than the return of the ASRS Strategic Asset Allocation Policy (SAAP) Benchmark.

	Quarter	1 Year	3 Years	5 Years	10 Years	Since Inception (6/30/75)
Total Fund	3.6%	16.0%	8.3%	9.7%	6.4%	9.8%
Interim SAA Policy¹	3.8%	15.6%	7.8%	8.9%	5.8%	9.5%
Excess Return	-0.2%	0.4%	0.5%	0.8%	0.6%	0.3%

1 Year Goal Met: Yes
3 Year Goal Met: Yes



¹Composition of SAA Policy can be found in the appendix.

TOTAL FUND ATTRIBUTION ANALYSIS

Total Plan	1 Year	3 Years	5 Years
Allocation Effect ¹	0.22%	0.18%	0.51%
Manager Selection Effect ²	0.18%	0.29%	0.38%
Residual ³	0.00%	0.01%	-0.02%
Excess Return	0.40%	0.48	0.87

The Brinson-Fachler Attribution model explains excess return by identifying the size of contributors or detractors from excess return based on the three effects defined below:

1. Allocation Effect: Measures the impact of the decision to over/under weight asset classes relative to Interim SAAP benchmark weights. $(\text{Return Asset Class Index} - \text{Total Interim Policy Index Return}) \times (\text{Weight Asset Class Portfolio} - \text{Weight Asset Class Interim Policy Index})$.

2. Manager Selection Effect: Measures the impact of over/under performance of asset classes in the portfolio relative to the asset class benchmarks in the Interim SAAP benchmark. $[\text{Weight Asset Class Benchmark} \times (\text{Return Portfolio Asset Class} - \text{Return Asset Class in Interim Policy Index})] + \text{Interaction Effect}$: Measures the impact of over/under weighting decisions and over/under performance. $(\text{Return Asset Class Portfolio} (\text{Weight Asset Class Portfolio} - \text{Weight Asset Class Policy Index})) - (\text{Return Asset Class Index} (\text{Weight Asset Class Portfolio} - \text{Weight Asset Class Index}))$.

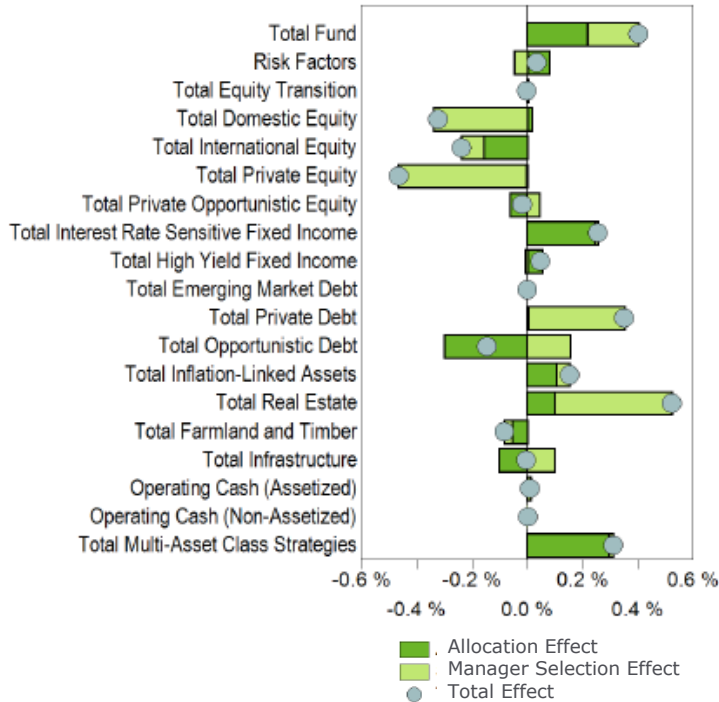
3. Residual: Contribution to excess return not captured in Allocation Effect and Manager Selection Effect.



TOTAL FUND ATTRIBUTION DETAIL

Attribution Effects
1 Year Ending December 31, 2017

1 Year Excess Return: 0.40%



- Allocation Effect: (+0.22%)
 - Multi-Asset Class Strategies underweight (+0.30%)
 - Inflation-Linked Assets underweight (+0.11%)
 - Real Estate underweight (+0.10%)
 - Opportunistic Debt tactical overweight (-0.30%)
- Manager Selection Effect: (+0.18%)
 - Real Estate outperformed (+0.42%)
 - Private Debt outperformed (+0.35%)
 - Opportunistic Debt outperformed (+0.15%)
 - Inflation-Linked Assets outperformed (0.05%)
 - Private Equity underperformed (-0.46%)
 - Domestic Equity underperformed (-0.34%)
- Residual: (+0.00%)

The Brinson-Fachler Attribution model explains excess return by identifying the size of contributors or detractors from excess return based on the three effects defined below:

Allocation Effect: Measures the impact of the decision to over/under weight asset classes relative to Interim SAAP benchmark weights. $(\text{Return Asset Class Index} - \text{Total Interim Policy Index Return}) \times (\text{Weight Asset Class Portfolio} - \text{Weight Asset Class Interim Policy Index})$.

Manager Selection Effect: Measures the impact of over/under performance of asset classes in the portfolio relative to the asset class benchmarks in the Interim SAAP benchmark. $[\text{Weight Asset Class Benchmark} \times (\text{Return Portfolio Asset Class} - \text{Return Asset Class in Interim Policy Index})]$ + **Interaction Effect:** Measures the impact of over/under weighting decisions and over/under performance. $(\text{Return Asset Class Portfolio} (\text{Weight Asset Class Portfolio} - \text{Weight Asset Class Policy Index})) - (\text{Return Asset Class Index} (\text{Weight Asset Class Portfolio} - \text{Weight Asset Class Index}))$.

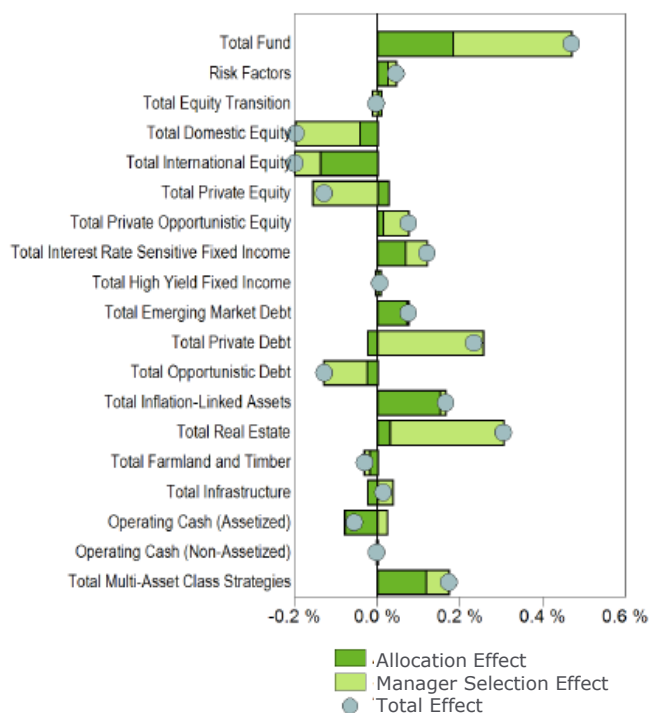
Residual: Contribution to excess return not captured in Allocation Effect and Manager Selection Effect.



TOTAL FUND ATTRIBUTION DETAIL

Attribution Effects
3 Years Ending December 31, 2017

3 Year Excess Return: +0.48%



- Allocation Effect: (+0.18%)
 - Public Markets Fixed Income tactical underweight (+0.15%)
 - Inflation-Linked Assets tactical underweight (+0.15%)
 - Multi-Asset Class Strategies underweight (+0.12%)
 - International Equity tactical underweight(-0.14%)
 - Assetized Cash overweight (-0.08)
- Manager Selection Effect: (+0.29%)
 - Real Estate outperformed due to various managers (+0.27%)
 - Private Debt outperformed due to various managers (+0.26%)
 - Private Opportunistic Equity outperformed due to various managers (+0.06%)
 - Private Equity underperformed (-0.16%)
 - Domestic Equity underperformed (-0.15%)
- Residual: (+0.01%)

The Brinson-Fachler Attribution model explains excess return by identifying the size of contributors or detractors from excess return based on the three effects defined below:

Allocation Effect: Measures the impact of the decision to over/under weight asset classes relative to Interim SAAP benchmark weights. $(\text{Return Asset Class Index} - \text{Total Interim Policy Index Return}) \times (\text{Weight Asset Class Portfolio} - \text{Weight Asset Class Interim Policy Index})$.

Manager Selection Effect: Measures the impact of over/under performance of asset classes in the portfolio relative to the asset class benchmarks in the Interim SAAP benchmark. $[\text{Weight Asset Class Benchmark} \times (\text{Return Portfolio Asset Class} - \text{Return Asset Class in Interim Policy Index})]$ + **Interaction Effect:** Measures the impact of over/under weighting decisions and over/under performance. $(\text{Return Asset Class Portfolio} (\text{Weight Asset Class Portfolio} - \text{Weight Asset Class Policy Index})) - (\text{Return Asset Class Index} (\text{Weight Asset Class Portfolio} - \text{Weight Asset Class Index}))$.

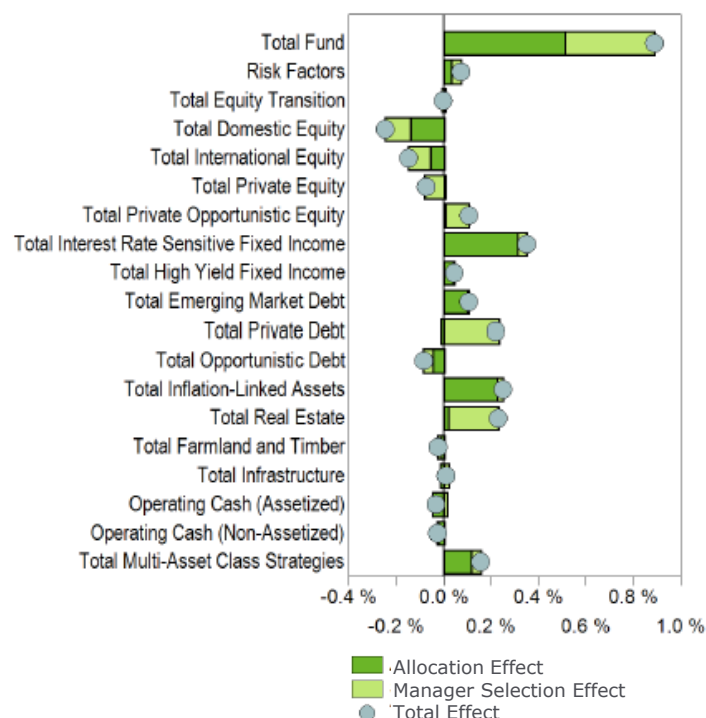
Residual: Contribution to excess return not captured in Allocation Effect and Manager Selection Effect.



TOTAL FUND ATTRIBUTION DETAIL

Attribution Effects
5 Years Ending December 31, 2017

5 Year Excess Return: +0.87%



- Allocation Effect: (+0.51%)
 - Public Markets Fixed Income tactical underweight (+0.45%)
 - Inflation-Linked Assets tactical underweight (+0.23%)
 - Multi-Asset Class Strategies underweight (+0.12%)
 - Domestic Equity underweight (-0.14%)
 - International Equity underweight (-0.06%)
 - Opportunistic Debt overweight (-0.05%)
 - Assetized Cash overweight (-0.05%)
- Manager Selection Effect: (+0.38%)
 - Private Debt outperformed due to various managers (+0.23%)
 - Real Estate outperformed due to various managers (+0.21%)
 - Public Markets Fixed Income outperformed (+0.05)
 - Domestic Equity underperformed (-0.11%)
- Residual: (-0.02%)

The Brinson-Fachler Attribution model explains excess return by identifying the size of contributors or detractors from excess return based on the three effects defined below:

Allocation Effect: Measures the impact of the decision to over/under weight asset classes relative to Interim SAAP benchmark weights. $(\text{Return Asset Class Index} - \text{Total Interim Policy Index Return}) \times (\text{Weight Asset Class Portfolio} - \text{Weight Asset Class Interim Policy Index})$.

Manager Selection Effect: Measures the impact of over/under performance of asset classes in the portfolio relative to the asset class benchmarks in the Interim SAAP benchmark. $[\text{Weight Asset Class Benchmark} \times (\text{Return Portfolio Asset Class} - \text{Return Asset Class in Interim Policy Index})]$ + **Interaction Effect:** Measures the impact of over/under weighting decisions and over/under performance. $(\text{Return Asset Class Portfolio} (\text{Weight Asset Class Portfolio} - \text{Weight Asset Class Policy Index})) - (\text{Return Asset Class Index} (\text{Weight Asset Class Portfolio} - \text{Weight Asset Class Index}))$.

Residual: Contribution to excess return not captured in Allocation Effect and Manager Selection Effect.



ASSET CLASS PERFORMANCE VS. BENCHMARK

– PUBLIC MARKETS

- Objective #3: Achieve one- and three-year rolling annual net rates of return for ASRS strategic asset classes that are equal to or greater than their respective strategic asset class benchmarks.

	1 Year Return	3 Year Return
ASRS Total Domestic and Int'l Equity ¹	23.0%	9.7%
ASRS Custom Total Equity Benchmark	24.0%	10.2%
Excess Return	-1.0%	-0.5%
ASRS Domestic Equity	18.8%	11.0%
ASRS Custom Domestic Equity Benchmark	20.2%	11.6%
Excess Return	-1.4%	-0.6%
ASRS International Equity	27.8%	8.4%
ASRS Custom Int'l Equity Benchmark	28.2%	8.6%
Excess Return	-0.4%	-0.2%
ASRS Public Markets Fixed Income	4.3%	3.4%
ASRS Custom Fixed Income Benchmark	4.4%	2.9%
Excess Return	-0.1%	0.5%
ASRS Inflation-Linked	5.5%	-4.2%
ASRS Custom Inflation-Linked Benchmark	1.7%	-5.0%
Excess Return	3.8%	0.8%
ASRS Multi-Asset Class Strategies	1.3%	0.6%
ASRS Multi-Asset Class Strategies Benchmark	0.8%	0.5%
Excess Return	0.5%	0.1%

**Goal Met:
Partially**

¹Performance of ASRS Total Domestic and Int'l Equity includes the performance of the ASRS Domestic Equity and ASRS International Equity asset classes and the Equity Risk Factor Portfolio with an inception date of 6/1/2013.

Note: Composition of ASRS Custom Asset Class Benchmarks can be found in the appendix.



ASSET CLASS PERFORMANCE VS. BENCHMARK – PRIVATE MARKETS

- Objective #3: Achieve one- and three-year rolling annual net rates of return for ASRS strategic asset classes that are equal to or greater than their respective strategic asset class benchmarks.

	1 Year Return	3 Year Return	IRR Since Inception	Inception Date
ASRS Private Equity	15.7%	10.6%	11.9%	Oct-07
Russell 2000	21.2%	12.3%	13.2%	
Excess Return	-5.6%	-1.7%	-1.2%	
ASRS Private Opportunistic Equity ²	13.2%	14.5%	21.2%	Apr-11
ASRS Private Debt	11.2%	10.5%	11.1%	Jul-12
S&P/LSTA Leveraged Loan Index + 250 bps	7.9%	7.1%	7.0%	
Excess Return	3.3%	3.4%	4.1%	
ASRS Opportunistic Debt ²	11.9%	5.3%	9.7%	Jan-08
ASRS Real Estate	11.0%	12.3%	8.4%	Oct-05
NFI - ODCE Index	7.0%	10.3%	7.3%	
Excess Return	4.0%	2.0%	1.2%	
ASRS Farmland and Timber	0.3%	2.9%	2.7%	Jul-13
CPI ex-Food and Energy + 350 bps	5.3%	5.5%	5.5%	
Excess Return	-5.0%	-2.6%	-2.8%	
ASRS Total Infrastructure	15.0%	--	9.3%	Dec-14
CPI ex-Food and Energy + 350 bps	5.3%	--	5.5%	
Excess Return	9.8%		3.8%	

**Goal Met:
Partially**

¹Performance of private markets portfolios and corresponding benchmarks is reported on a one quarter lag on an IRR basis. Performance shown as of September 30, 2017.

²Net absolute rate of return expectations range from 10-14% per annum.

Note: Due to the drawdown nature of private markets portfolios in which the investment managers call capital over time, dollar-weighted performance, or internal rate of return (IRR), is a more appropriate measure of the performance of ASRS private markets portfolios. Numbers represent point to point IRRs.



CASH MANAGEMENT

- Objective #4: Ensure sufficient monies are available to meet pension benefits, health insurance, member refunds, administrative payments, and other cash flow requirements.

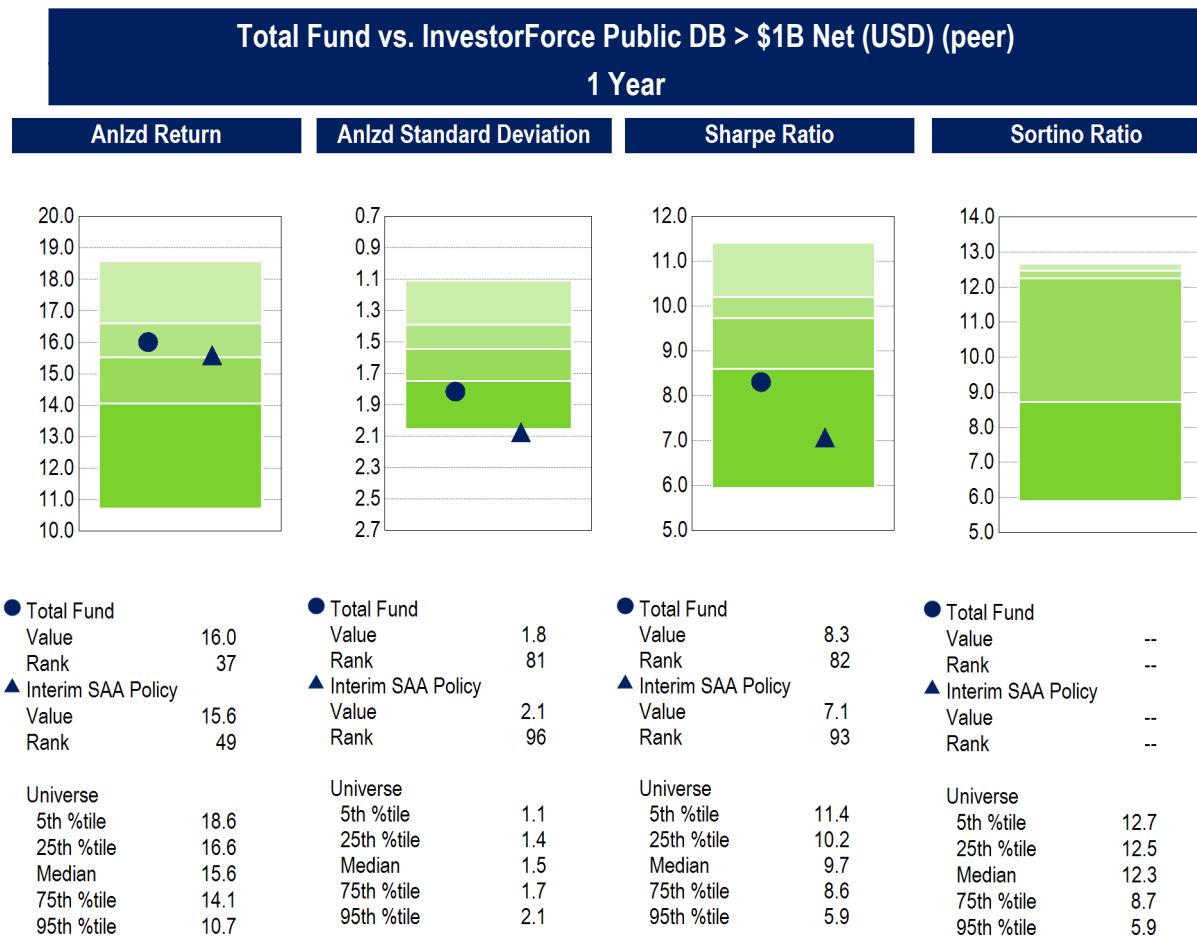
Month	External CFs	Last day of the Month Ending Balance*
Dec - 16	(\$79.8)	\$620.1
Jan - 17	(\$115.9)	\$538.0
Feb - 17	(\$106.1)	\$455.0
Mar - 17	(\$69.8)	\$72.3
Apr - 17	(\$108.3)	\$420.5
May - 17	(\$83.2)	\$375.5
Jun - 17	(\$78.0)	\$58.4
Jul - 17	(\$173.1)	\$369.5
Aug - 17	(\$143.8)	\$93.9
Sep - 17	(\$88.6)	\$115.6
Oct - 17	(\$105.9)	\$383.9
Nov - 17	(\$110.4)	\$127.1
Dec - 17	(\$85.5)	\$861.3

*Includes assetized & unassetized cash balances (Inception of 1/26/15); represents monies to be used for funding needs that occur in subsequent month(s). Generally, monthly pension payments occur on the first day of month.

**Goal Met:
Yes**



TOTAL FUND RISK STATISTICS VS. PEER UNIVERSE



Note: The information contained herein is for comparison purposes only and is not a Total Fund benchmark. Peer universe comparisons are subject to several limitations, including: peer groups are not comprehensive; several funds are included in multiple peer groups; peer groups are constructed using net of fee returns; and survivorship bias in that poorly performing funds may no longer report results.

Universes are constructed using net of fee returns; therefore, ASRS rank is based on net of fee returns.

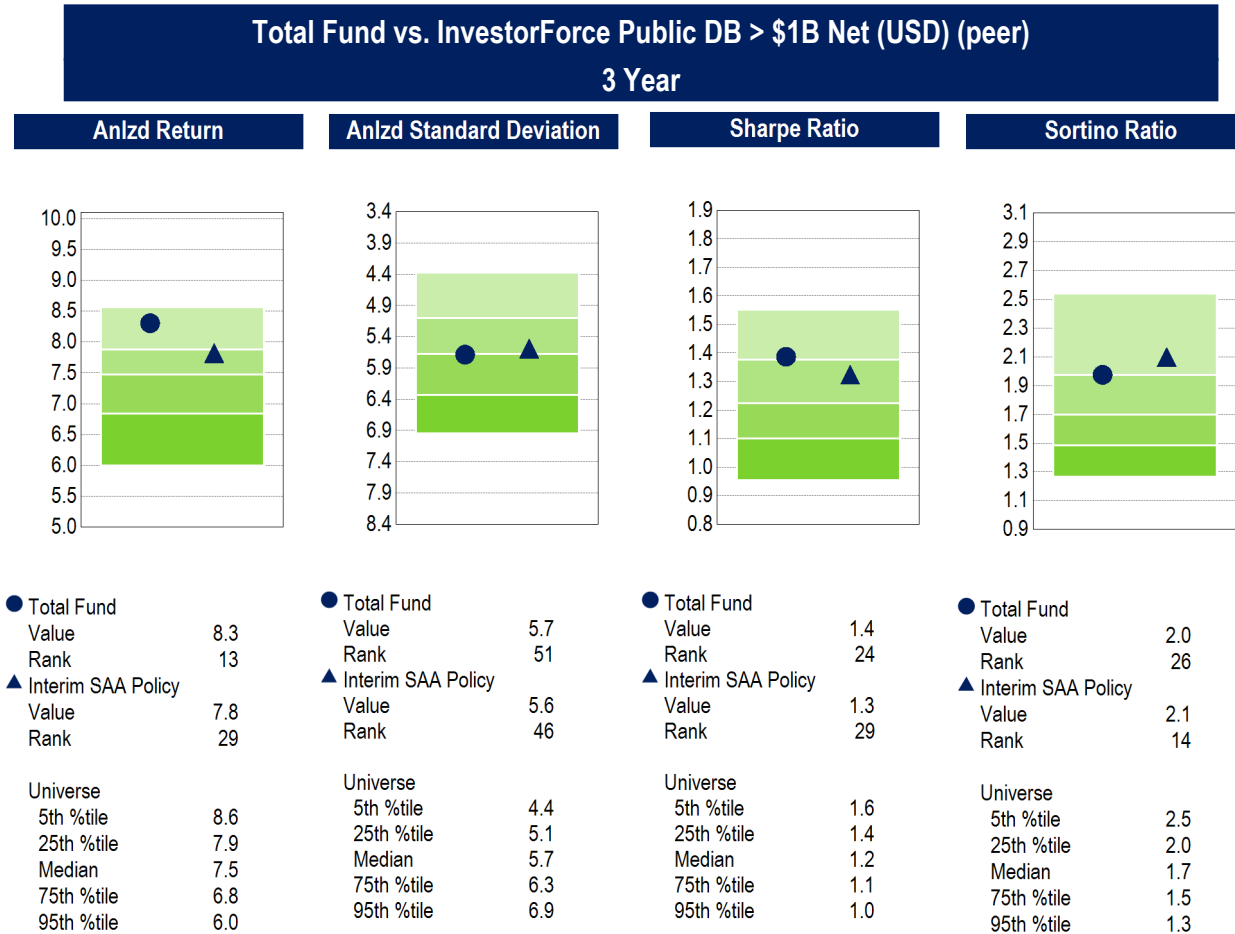
Rankings are from highest (1) to lowest (100) in the InvestorForce Public Funds > \$1 Billion Net Universe.

The InvestorForce Public Funds > \$1 Billion Net Universe contains 54 observations for the period ending Sept 30, 2017, with total assets of \$514.4 billion.

Composition of Interim SAA Policy can be found in the appendix.



TOTAL FUND RISK STATISTICS VS. PEER UNIVERSE



Note: The information contained herein is for comparison purposes only and is not a Total Fund benchmark. Peer universe comparisons are subject to several limitations, including: peer groups are not comprehensive; several funds are included in multiple peer groups; peer groups are constructed using net of fee returns; and survivorship bias in that poorly performing funds may no longer report results.

Universes are constructed using net of fee returns; therefore, ASRS rank is based on net of fee returns.

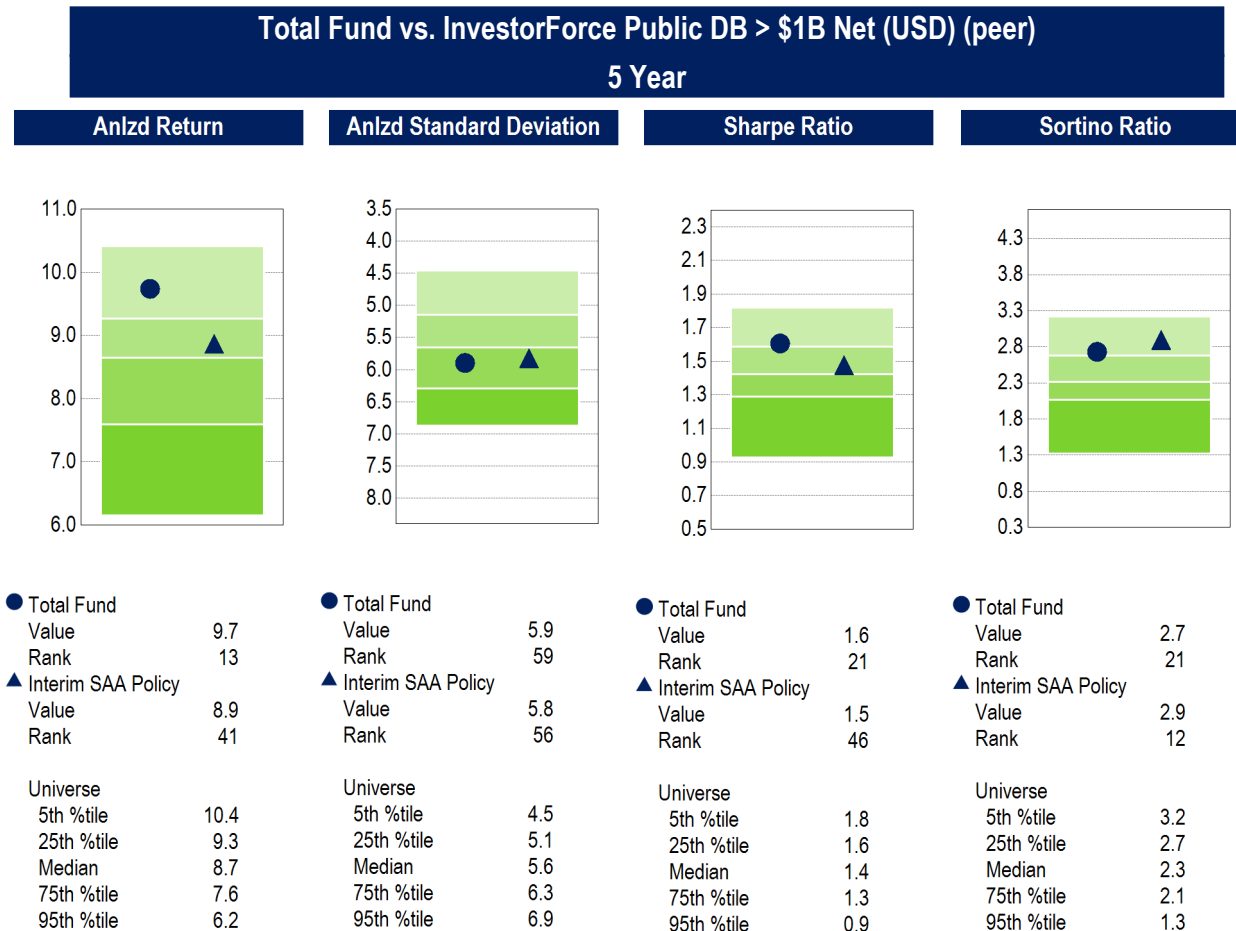
Rankings are from highest (1) to lowest (100) in the InvestorForce Public Funds > \$1 Billion Net Universe.

The InvestorForce Public Funds > \$1 Billion Net Universe contains 54 observations for the period ending Sept 30, 2017, with total assets of \$514.4 billion.

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TOTAL FUND RISK STATISTICS VS. PEER UNIVERSE



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Rankings are from highest (1) to lowest (100) in the InvestorForce Public Funds > \$1 Billion Net Universe.

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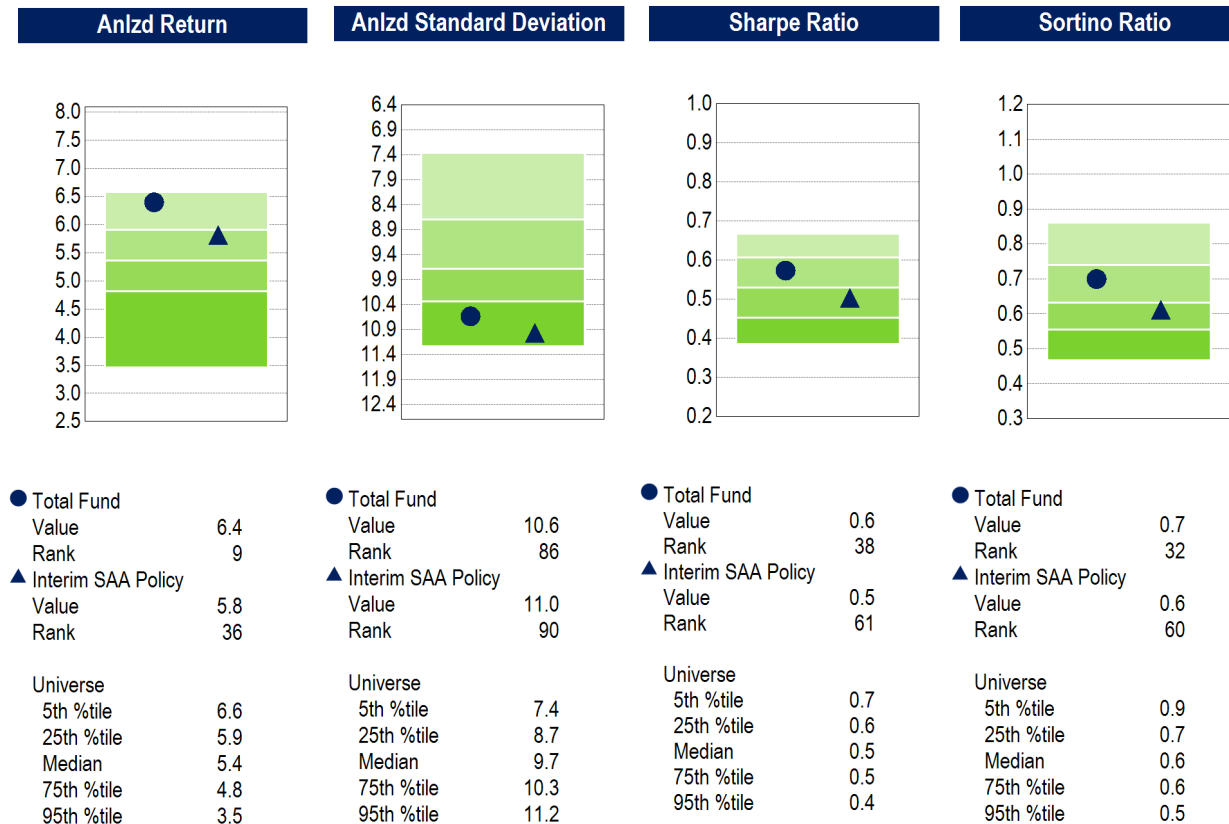
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TOTAL FUND RISK STATISTICS VS. PEER UNIVERSE

Total Fund vs. InvestorForce Public DB > \$1B Net (USD) (peer)

10 Year



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Universes are constructed using net of fee returns; therefore, ASRS rank is based on net of fee returns.

Rankings are from highest (1) to lowest (100) in the InvestorForce Public Funds > \$1 Billion Net Universe.

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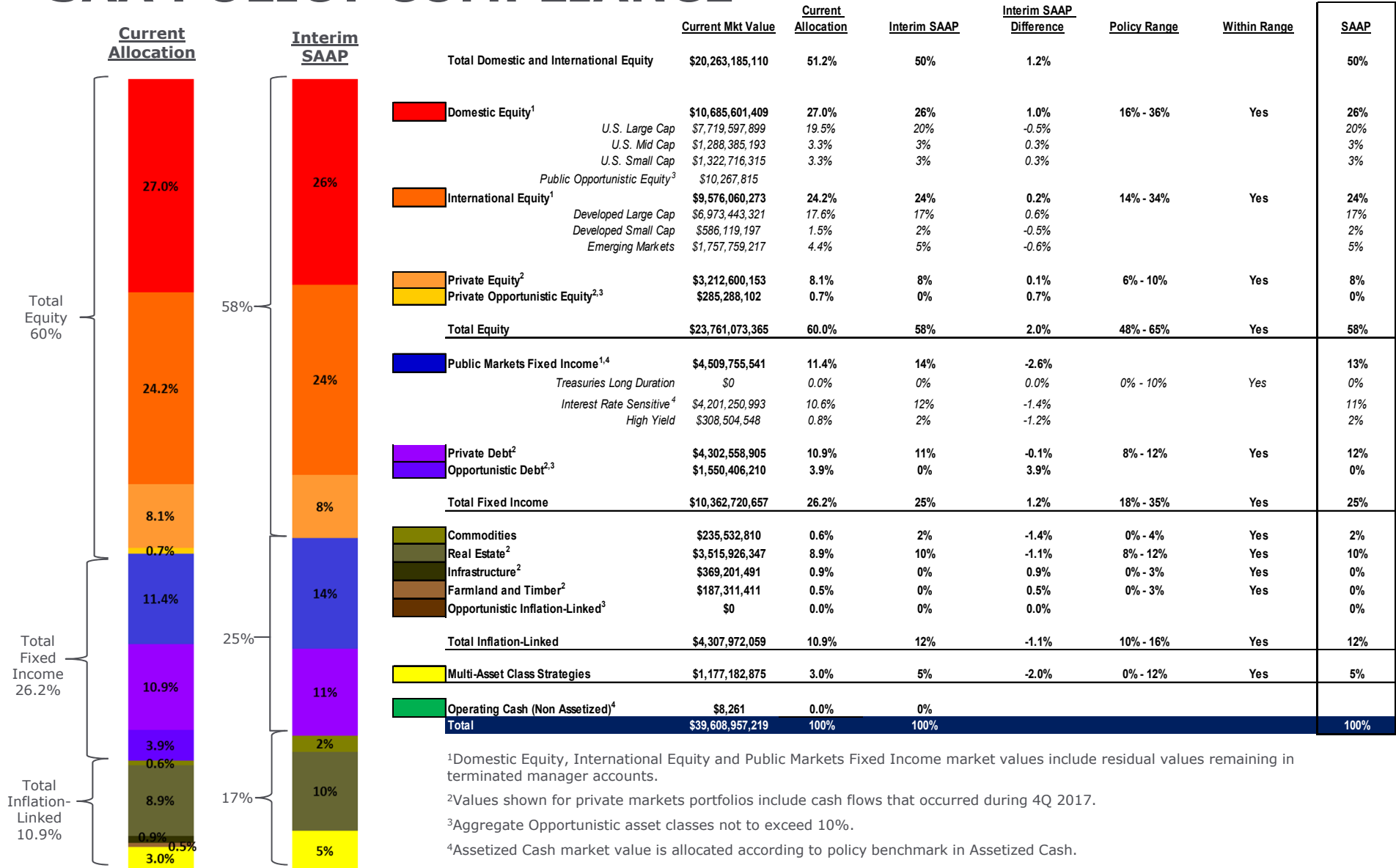


INDEPENDENT OVERSIGHT/COMPLIANCE

Note: All of the data shown on the following pages is as of December 31, 2017 and reflects the deduction of investment manager fees, unless otherwise noted.

NEPC, LLC

SAA POLICY COMPLIANCE



¹Domestic Equity, International Equity and Public Markets Fixed Income market values include residual values remaining in terminated manager accounts.

²Values shown for private markets portfolios include cash flows that occurred during 4Q 2017.

³Aggregate Opportunistic asset classes not to exceed 10%.

⁴Assetized Cash market value is allocated according to policy benchmark in Assetized Cash.

Note: Interim SAA Policy includes proration of 1% Private Debt which is unfunded.

Policy Ranges shown are relative to the long-term SAAP and may cause some asset classes to be out of range while implementation of the long-term SAAP is in process.

Market values include manager held cash.



PERFORMANCE SUMMARY – PUBLIC MARKETS

	Market Value (\$)	% of Portfolio	3 Mo (%)	Rank	YTD (%)	Rank	1 Yr (%)	Rank	3 Yrs (%)	Rank	5 Yrs (%)	Rank	10 Yrs (%)	Rank	Inception (%)	Since
Total Fund	39,608,957,219	100.0	3.6	--	16.0	--	16.0	--	8.3	--	9.7	--	6.4	--	9.8	Jul-75
Interim SAA Policy			<u>3.8</u>		<u>15.6</u>		<u>15.6</u>		<u>7.8</u>		<u>8.9</u>		<u>5.8</u>		<u>9.5</u>	Jul-75
Over/Under			-0.2		0.4		0.4		0.5		0.8		0.6		0.3	
InvestorForce Public DB > \$1B Net Median			3.5		15.1		15.1		7.4		8.6		5.4		--	Jul-75
Total Domestic and International Equity	19,660,298,634	49.6	5.2	72	23.0	71	23.0	71	9.7	55	12.0	38	6.6	17	7.2	Jan-98
ASRS Custom Total Equity Benchmark			<u>5.7</u>	32	<u>24.0</u>	43	<u>24.0</u>	43	<u>10.2</u>	24	<u>12.3</u>	25	<u>6.6</u>	17	<u>6.7</u>	Jan-98
Over/Under			-0.5		-1.0		-1.0		-0.5		-0.3		0.0		0.5	
InvestorForce Public DB > \$1 Billion Total Equity Net Median			5.5		23.7		23.7		9.9		11.6		5.9		6.3	
Total Domestic Equity	10,341,094,850	26.1	5.9	83	18.8	75	18.8	75	11.0	25	15.4	37	9.0	5	11.4	Jul-75
ASRS Custom Domestic Equity Benchmark			<u>6.3</u>	46	<u>20.2</u>	64	<u>20.2</u>	64	<u>11.6</u>	3	<u>15.8</u>	7	<u>9.0</u>	5	<u>11.5</u>	Jul-75
Over/Under			-0.4		-1.4		-1.4		-0.6		-0.4		0.0		-0.1	
InvestorForce Public DB > \$1 Billion US Equity Net Median			6.2		20.9		20.9		10.8		15.1		8.3		--	Jul-75
Total International Equity	9,317,680,354	23.5	4.5	74	27.8	57	27.8	57	8.4	76	7.1	82	2.3	68	6.3	Apr-87
ASRS Custom Int'l Equity Benchmark			<u>5.1</u>	47	<u>28.2</u>	55	<u>28.2</u>	55	<u>8.6</u>	69	<u>7.5</u>	64	<u>2.5</u>	48	<u>6.1</u>	Apr-87
Over/Under			-0.6		-0.4		-0.4		-0.2		-0.4		-0.2		0.2	
InvestorForce Public DB > \$1 Billion Global ex-US Equity Net Median			5.0		28.8		28.8		9.1		8.0		2.5		--	Apr-87
Total Public Markets Fixed Income	4,251,375,622	10.7	0.5	69	4.3	87	4.3	87	3.4	60	2.3	74	4.5	75	8.1	Jan-00
ASRS Custom Public Markets Fixed Income Benchmark			<u>0.4</u>	84	<u>4.4</u>	86	<u>4.4</u>	86	<u>2.9</u>	75	<u>2.1</u>	89	<u>4.1</u>	97	<u>--</u>	Jul-75
Over/Under			0.1		-0.1		-0.1		0.5		0.2		0.4		--	
InvestorForce Public DB > \$1 Billion Fixed Income Net Median			0.6		6.3		6.3		3.7		3.0		5.2		--	Jul-75
Total Inflation-Linked Assets	235,532,810	0.6	6.4	1	5.5	56	5.5	56	-4.2	97	-7.5	99	--	--	-3.6	Feb-10
ASRS Custom Inflation-Linked Benchmark			<u>4.7</u>	14	<u>1.7</u>	85	<u>1.7</u>	85	<u>-5.0</u>	99	<u>-8.5</u>	99	<u>-3.1</u>	79	<u>-5.1</u>	Feb-10
Over/Under			1.7		3.8		3.8		0.8		1.0		--		1.5	
InvestorForce Public DB > \$1 Billion Real Assets/Commodities Net Median			2.2		6.0		6.0		1.6		2.5		0.0		5.4	Feb-10
Total Multi-Asset Class Strategies	1,177,182,875	3.0	2.3	96	1.3	99	1.3	99	0.6	99	4.8	28	5.2	5	6.3	Jan-04
Multi-Asset Class Strategies Custom Benchmark			<u>0.3</u>	99	<u>0.8</u>	99	<u>0.8</u>	99	<u>0.5</u>	99	<u>4.8</u>	29	<u>3.6</u>	99	<u>5.2</u>	Jan-04
Over/Under			2.0		0.5		0.4		0.1		0.1		1.6		1.2	
InvestorForce Public DB > \$1 Billion Global Tactical Net Median			3.6		13.3		13.3		4.9		4.3		4.8		6.3	Jan-04
Operating Cash (Assetized)	861,266,398	2.2	3.4	--	17.2	--	17.2	--	--	--	--	--	--	--	4.4	Feb-15
ASRS Cash Assetization Custom Benchmark			<u>3.6</u>	--	<u>15.9</u>	--	<u>15.9</u>	--	--	--	--	--	--	--	<u>2.2</u>	Feb-15
Over/Under			-0.2		1.3		1.3		--		--		--		2.2	

¹Performance of ASRS Total Domestic and International Equity includes the performance of the ASRS Domestic and International Equity asset classes and the Equity Risk Factor Portfolio with an inception date of 6/1/2013. NEPC began calculating Total Domestic and International Equity performance in January 2009. Monthly performance data from January 1998 - December 2008 was provided by State Street.

Note: Performance, ranks and medians are based on net of fee performance data. Rankings are from highest (1) to lowest (100) in the eVestment Universe.

Universe shown for Total Public Markets Fixed Income includes all U.S. fixed income strategies and does not accurately represent the exposures of the ASRS Public Markets Fixed Income allocation, which has included allocations ranging from 10% - 25% to emerging markets debt historically.

Composition of Interim SAA Policy and ASRS Custom Asset Class Benchmarks can be found in the appendix.



PERFORMANCE SUMMARY – PRIVATE MARKETS

	Market Value (\$)	% of Portfolio	3 Mo (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	Inception (%)	Since
Total Fund	39,608,957,219	100.0	3.6	16.0	8.3	9.7	9.8	Jul-75
<i>Interim SAA Policy</i>			<u>3.8</u>	<u>15.6</u>	<u>7.8</u>	<u>8.9</u>	<u>9.5</u>	<i>Jul-75</i>
<i>Over/Under</i>			-0.2	0.5	0.5	0.8	0.3	
<i>Actual Benchmark</i>			3.5	15.1	7.4	8.6	--	<i>Jul-75</i>
Total Private Equity	3,273,147,597	8.1	4.0	15.7	10.6	12.9	11.9	Oct-07
<i>Russell 2000 1 QTR Lagged</i>			<u>6.1</u>	<u>21.2</u>	<u>12.3</u>	<u>13.6</u>	<u>13.2</u>	<i>Oct-07</i>
<i>Over/Under</i>			-2.1	-5.5	-1.7	-0.7	-1.3	
Total Private Opportunistic Equity¹	275,175,522	0.7	-0.9	13.2	14.5	20.6	21.2	Apr-11
			-	-	-	-	-	
Total Private Debt	4,200,647,915	10.9	2.3	11.2	10.5	11.1	11.1	Jul-12
<i>S&P/LSTA Leveraged Loan Index + 250 bps 1 QTR Lagged</i>			<u>1.7</u>	<u>7.9</u>	<u>7.1</u>	<u>7.0</u>	<u>7.0</u>	<i>Jul-12</i>
<i>Over/Under</i>			0.6	3.3	3.4	4.1	4.1	
Total Opportunistic Debt¹	1,584,901,735	3.9	2.0	11.9	5.3	7.0	9.7	Jan-08
			-	-	-	-	-	
Total Real Estate	3,424,950,902	8.9	1.7	11.0	12.3	12.8	8.4	Oct-05
<i>NCREIF ODCE 1 QTR Lagged (net)</i>			<u>1.6</u>	<u>7.0</u>	<u>10.3</u>	<u>10.8</u>	<u>7.3</u>	<i>Oct-05</i>
<i>Over/Under</i>			0.1	4.0	2.0	2.0	1.1	
Total Farmland and Timber	187,311,411	0.5	-0.1	0.3	2.9	--	2.7	Jul-13
<i>CPI ex-Food and Energy + 350 bps 1 QTR Lagged</i>			<u>1.4</u>	<u>5.3</u>	<u>5.5</u>	<u>--</u>	<u>5.5</u>	<i>Jul-13</i>
<i>Over/Under</i>			-1.5	-5.0	-2.6	--	-2.8	
Total Infrastructure	371,651,750	0.9	3.3	15.0	--	--	9.3	Dec-14
<i>CPI ex-Food and Energy + 350 bps 1 QTR Lagged</i>			<u>1.4</u>	<u>5.3</u>	<u>--</u>	<u>--</u>	<u>5.5</u>	<i>Dec-14</i>
<i>Over/Under</i>			1.9	9.8	--	--	3.8	

¹Net absolute rate of return expectations range from 10-14% per annum.

Note: Performance in private markets asset classes is based on net of fee dollar-weighted performance data.

Due to the drawdown nature of private markets portfolios in which the investment managers call capital over time, dollar-weighted performance, or internal rate of return (IRR), is a more appropriate measure of the performance of ASRS private markets portfolios.

Performance of private markets portfolios and corresponding benchmarks is reported on a one quarter lag. Performance shown as of September 30, 2017. Performance data and market values provided by State Street.

Prior to 3Q 2012, performance of the Total Private Debt and Total Opportunistic Debt asset classes was reported in aggregate. Effective 6/30/2012, the Fund's allocations to Private Debt and Opportunistic Debt were separated and will be reported separately going forward.

Composition of Interim SAA Policy can be found in the appendix.



PUBLIC MARKET ASSET CLASS ANALYSIS

3 Years Ending December 31, 2017													
	% of Tot	Anlzd Ret	Rank	Anlzd Std Dev	Rank	Tracking Error	Rank	Info Ratio	Rank	Anlzd AJ	Rank	Beta	Sharpe Ratio
Total Domestic and International Equity	49.6%	9.7%	55	10.1%	26	0.6%	4	-0.9		-0.2%	82	1.0	0.9
ASRS Custom Total Equity Benchmark	--	10.2%	24	10.4%	90	--	--	--	--	--	68	--	0.9
Total Domestic Equity	26.1%	11.0%	25	10.0%	11	0.5%	8	-1.3		-0.3%	44	1.0	1.1
ASRS Custom Domestic Equity Benchmark	--	11.6%	3	10.2%	40	--	--	--	--	--	15	--	1.1
Total International Equity	23.5%	8.4%	76	11.8%	77	0.9%	2	-0.3		-0.1%	95	1.0	0.7
ASRS Custom Int'l Equity Benchmark	--	8.6%	69	12.0%	89	--	--	--	--	--	94	--	0.7
Total Public Markets Fixed Income	10.7%	3.4%	60	2.6%	25	0.8%	22	0.5	49	0.7%	72	0.9	1.1
ASRS Custom Public Markets Fixed Income Benchmark	--	2.9%	75	2.7%	35	--	--	--	--	--	96	--	0.9
Total Inflation-Linked Assets	0.6%	-4.2%	97	13.2%	95	2.6%	10	0.3	48	1.1%	79	1.0	-0.3
ASRS Custom Inflation-Linked Benchmark	--	-5.0%	99	12.5%	94	--	--	--	--	--	83	--	-0.4
Total Multi-Asset Class Strategies	3.0%	0.6%	99	6.9%	97	6.2%	84	0.0	13	0.1%	34	1.2	0.0
Multi-Asset Class Strategies Custom Benchmark	--	0.5%	99	2.5%	1	--	--	--	--	--	35	--	0.0

Note: Performance is reported net of fees.

Underlying composites do not add up to 100% because the chart excludes private market composites.

Ranks for statistics shown above are based on the respective universe against which the portfolio is ranked on the asset class performance summary that precedes this section of the analysis.

Rankings are from highest (1) to lowest (100) in the eVestment Universe.

Composition of Interim SAA Policy and ASRS Custom Benchmarks can be found in the appendix.



PUBLIC MARKET ASSET CLASS ANALYSIS

5 Years Ending December 31, 2017

	% of Tot	Anlzd Ret	Rank	Anlzd Std Dev	Rank	Tracking Error	Rank	Info Ratio	Rank	Anlzd AJ	Rank	Beta	Sharpe Ratio
Total Domestic and International Equity	49.6%	12.0%	38	9.7%	28	0.6%	4	-0.4		0.0%	70	1.0	1.2
ASRS Custom Total Equity Benchmark	--	12.3%	25	9.9%	66	--	--	--	--	--	77	--	1.2
Total Domestic Equity	26.1%	15.4%	37	9.7%	22	0.5%	7	-0.9		-0.2%	24	1.0	1.6
ASRS Custom Domestic Equity Benchmark	--	15.8%	7	9.8%	35	--	--	--	--	--	10	--	1.6
Total International Equity	23.5%	7.1%	82	11.3%	70	0.8%	2	-0.5		-0.3%	94	1.0	0.6
ASRS Custom Int'l Equity Benchmark	--	7.5%	64	11.5%	85	--	--	--	--	--	92	--	0.6
Total Public Markets Fixed Income	10.7%	2.3%	74	3.4%	66	0.7%	14	0.3	63	0.2%	77	1.0	0.6
ASRS Custom Public Markets Fixed Income Benchmark	--	2.1%	89	3.4%	65	--	--	--	--	--	85	--	0.6
Total Inflation-Linked Assets	0.6%	-7.5%	99	12.4%	99	2.4%	10	0.4	68	1.0%	69	1.0	-0.6
ASRS Custom Inflation-Linked Benchmark	--	-8.5%	99	12.0%	99	--	--	--	--	--	76	--	-0.7
Total Multi-Asset Class Strategies	3.0%	4.8%	28	7.4%	84	4.9%	62	0.0	1	-0.7%	26	1.2	0.6
Multi-Asset Class Strategies Custom Benchmark	--	4.7%	29	4.8%	6	--	--	--	--	--	20	--	0.9

Note: Performance is reported net of fees.

Underlying composites do not add up to 100% because the chart excludes private market composites.

Ranks for statistics shown above are based on the respective universe against which the portfolio is ranked on the asset class performance summary that precedes this section of the analysis.

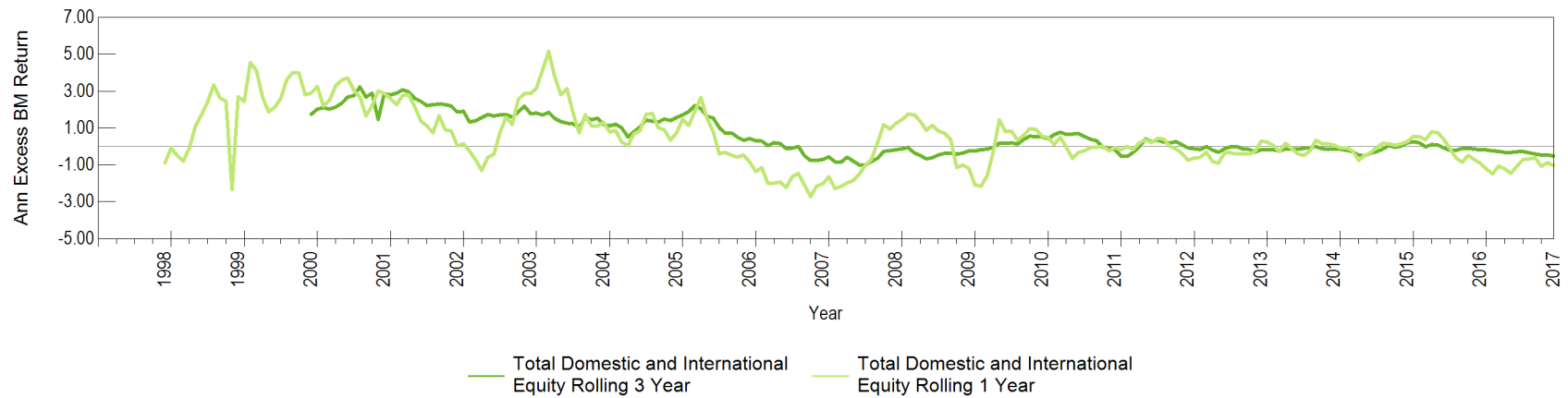
Rankings are from highest (1) to lowest (100) in the eVestment Universe.

Composition of Interim SAA Policy and ASRS Custom Benchmarks can be found in the appendix.

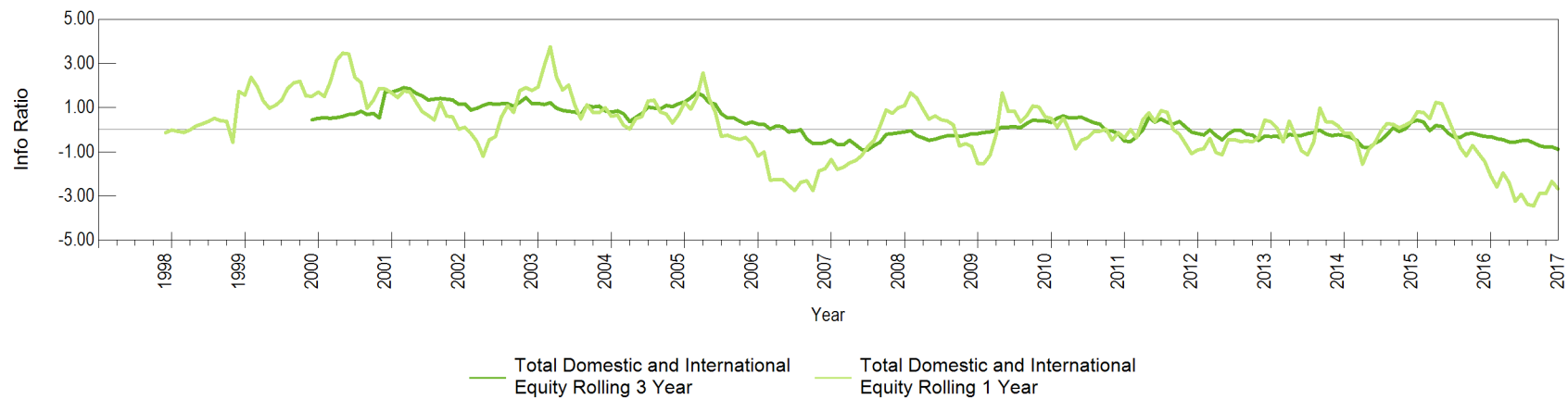


ASSET CLASS ANALYSIS - TOTAL DOMESTIC AND INTERNATIONAL EQUITY

Rolling Annual Excess Benchmark Return

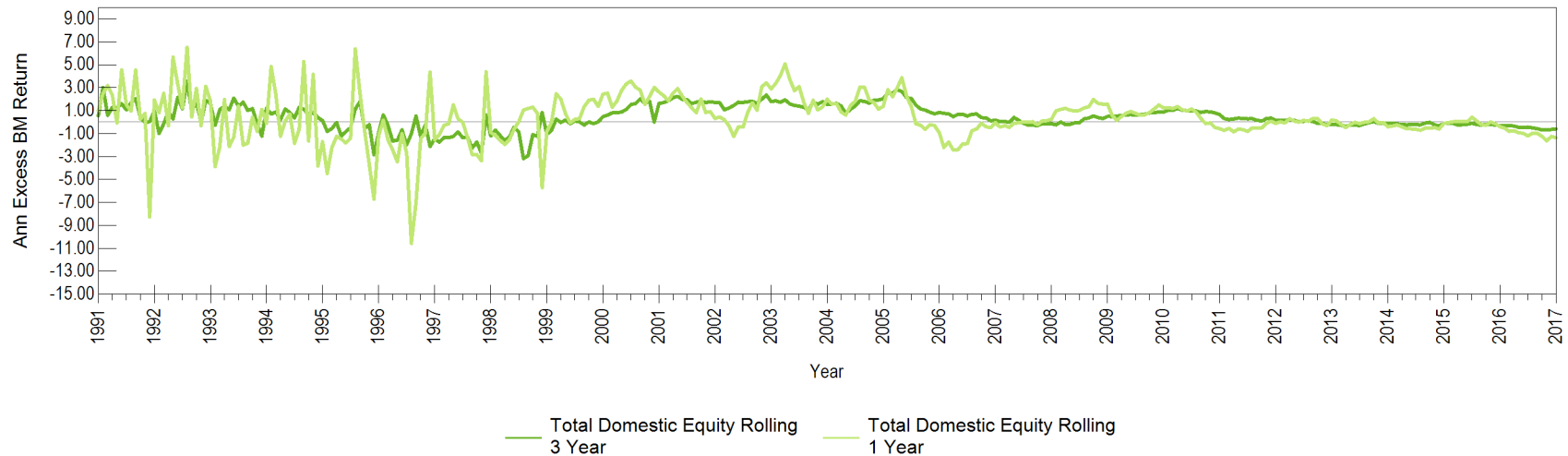


Rolling Information Ratio



ASSET CLASS ANALYSIS - TOTAL DOMESTIC EQUITY

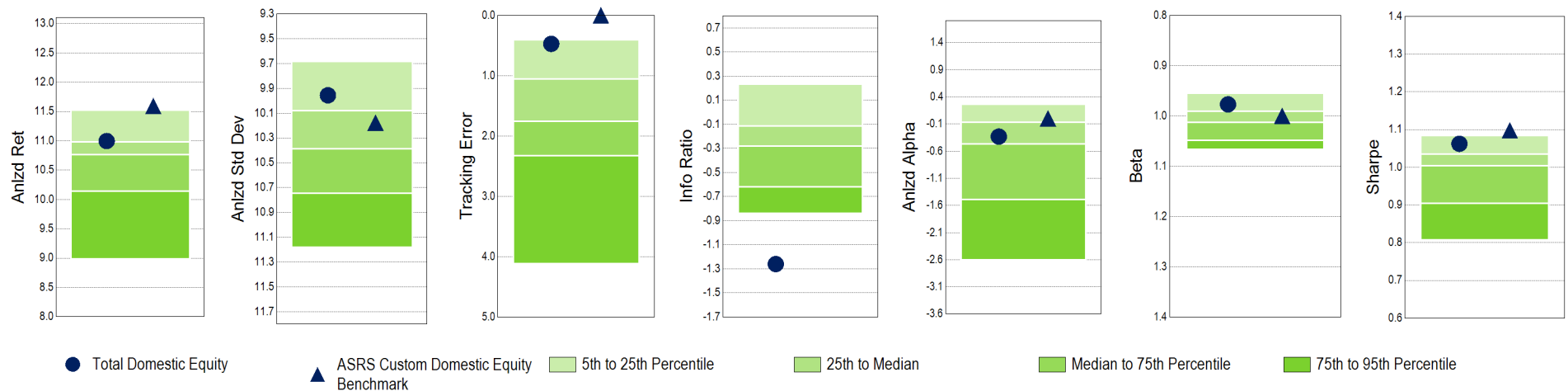
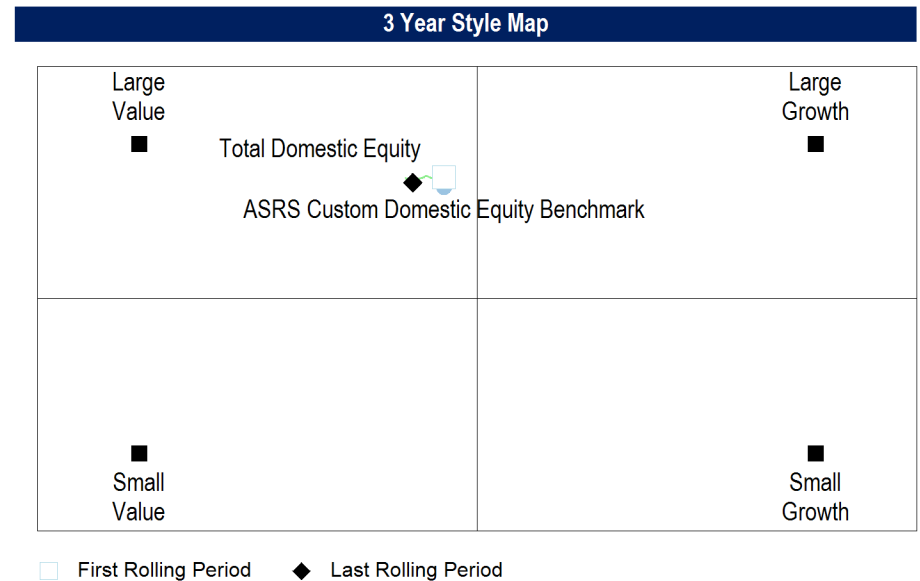
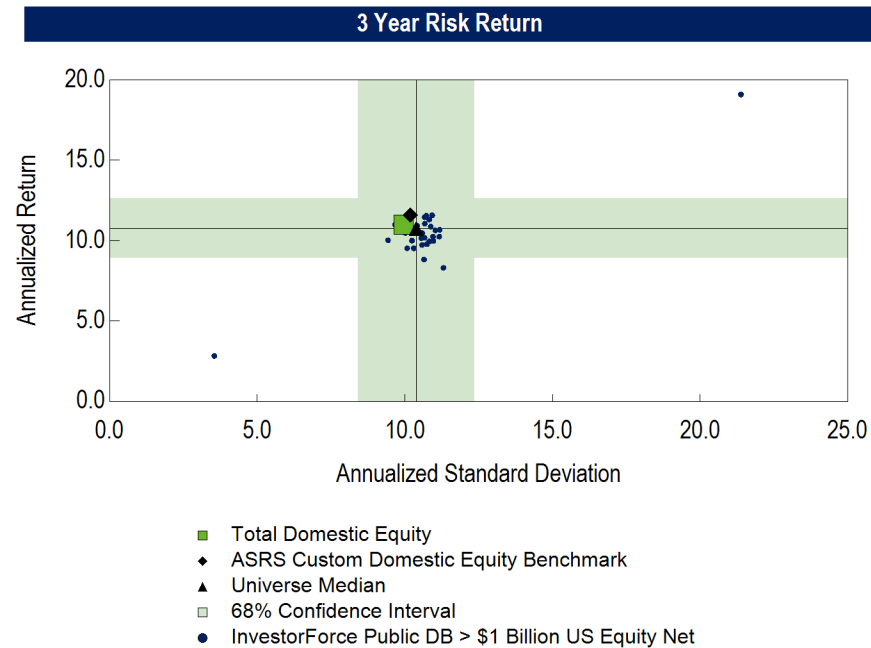
Rolling Annual Excess Benchmark Return



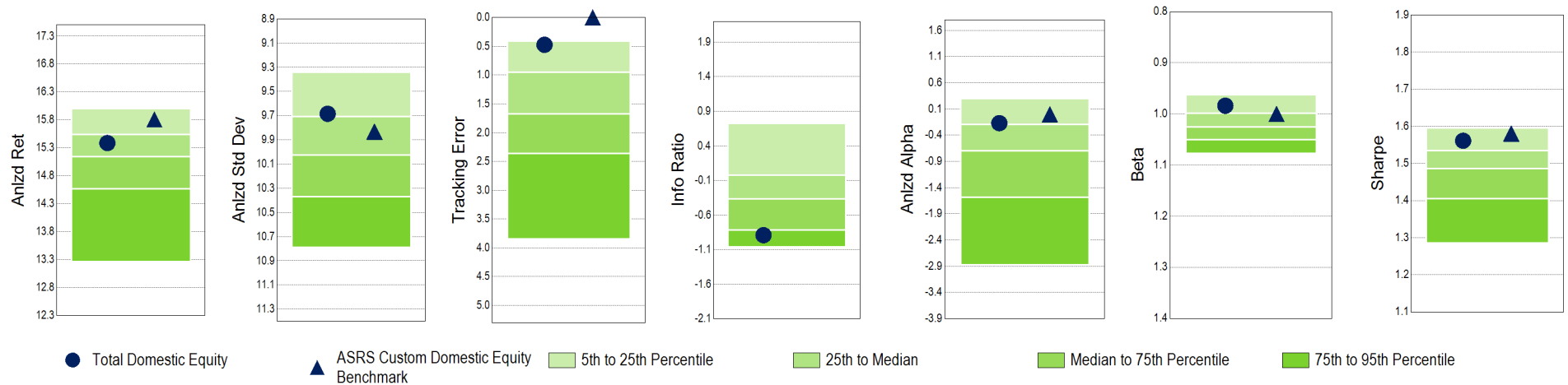
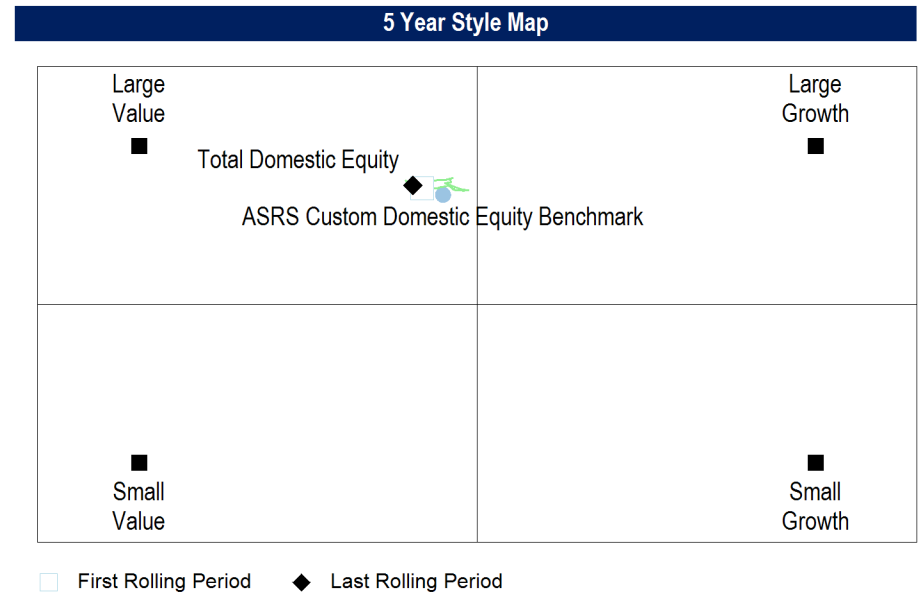
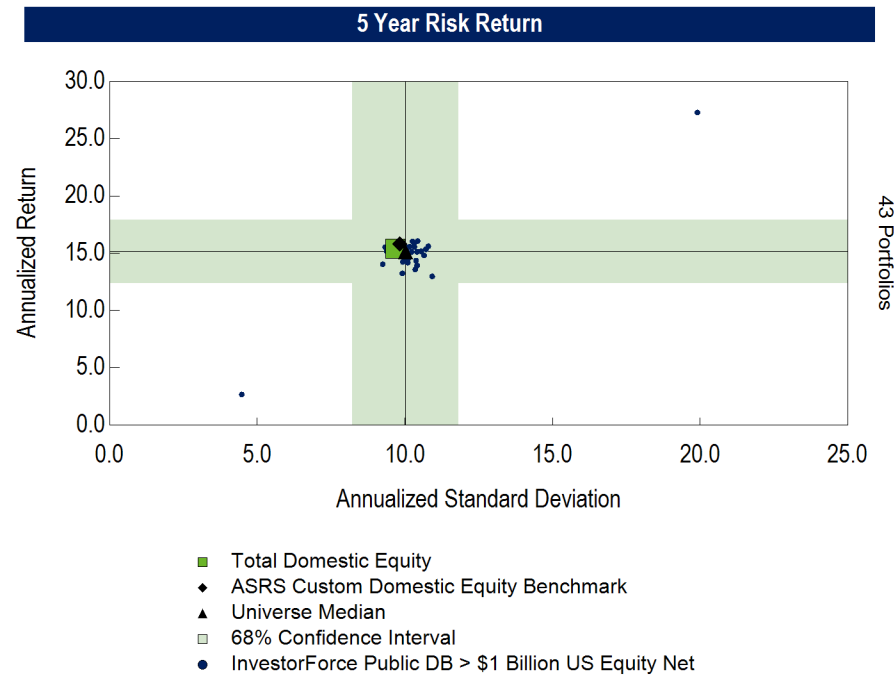
InvestorForce Public DB > \$1 Billion US Equity Net Accounts



ASSET CLASS ANALYSIS - TOTAL DOMESTIC EQUITY

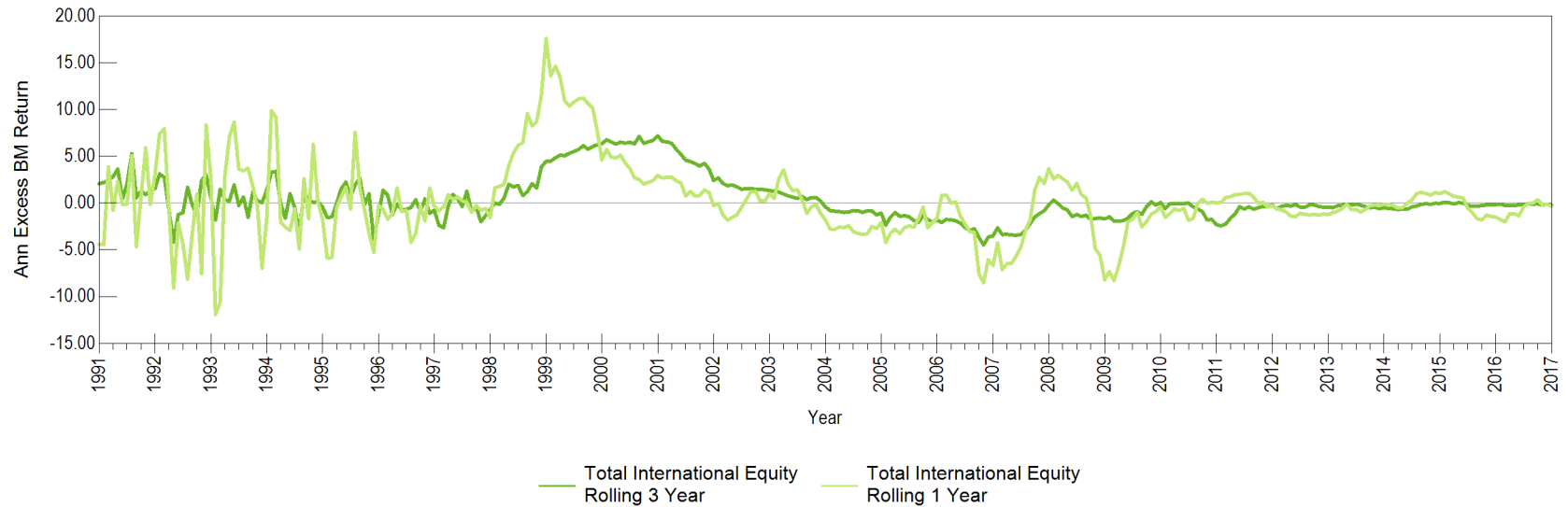


ASSET CLASS ANALYSIS - TOTAL DOMESTIC EQUITY



ASSET CLASS ANALYSIS - TOTAL INTERNATIONAL EQUITY

Rolling Annual Excess Benchmark Return

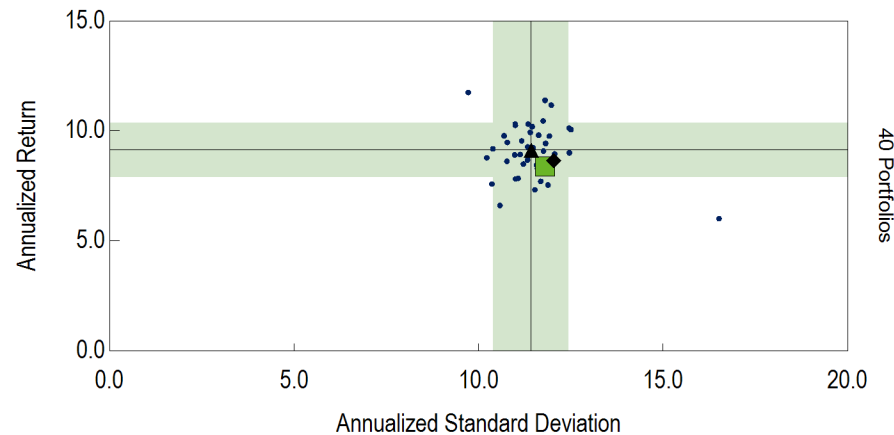


InvestorForce Public DB > \$1 Billion Global ex-US Equity Net Accounts



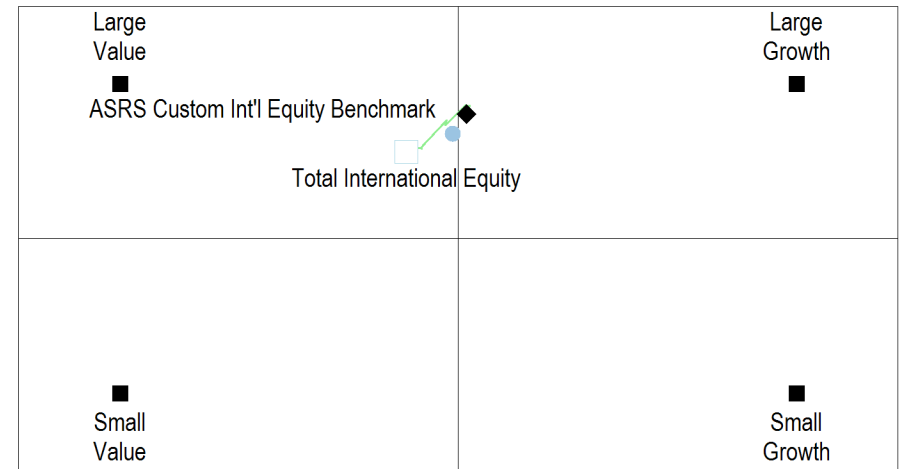
ASSET CLASS ANALYSIS - TOTAL INTERNATIONAL EQUITY

3 Year Risk Return

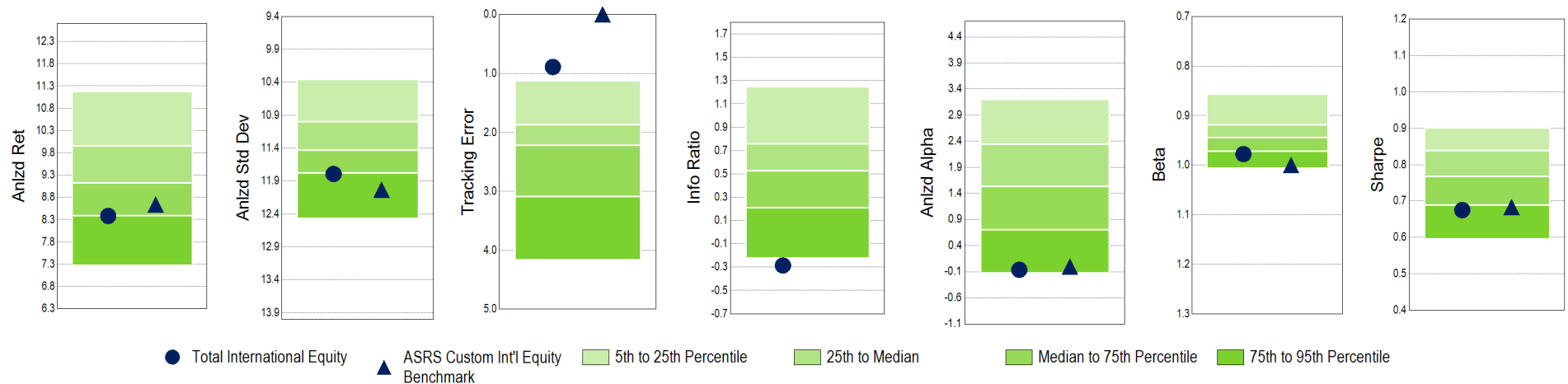


- Total International Equity
- ◆ ASRS Custom Int'l Equity Benchmark
- ▲ Universe Median
- 68% Confidence Interval
- InvestorForce Public DB > \$1 Billion Global ex-US Equity Net

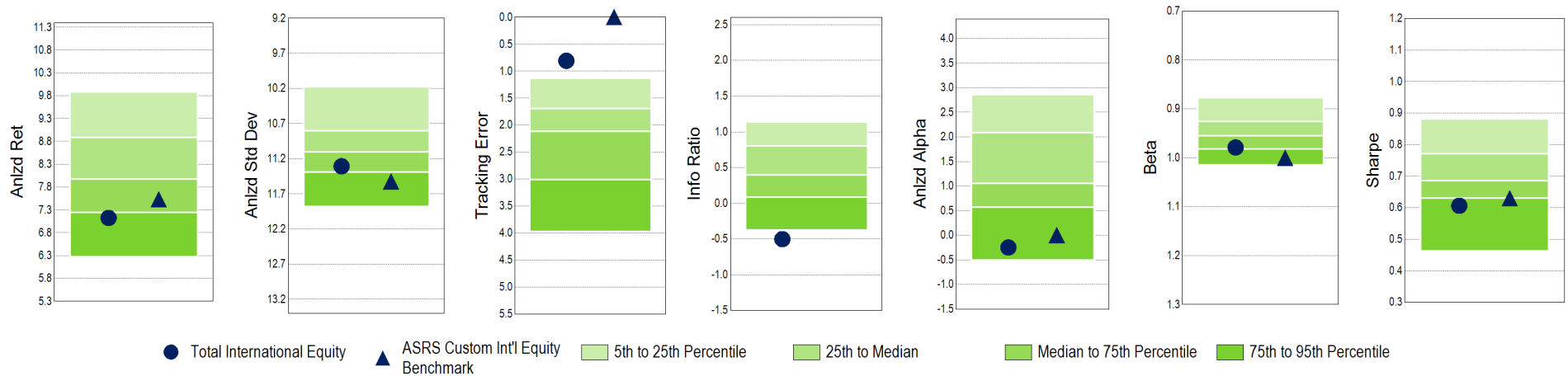
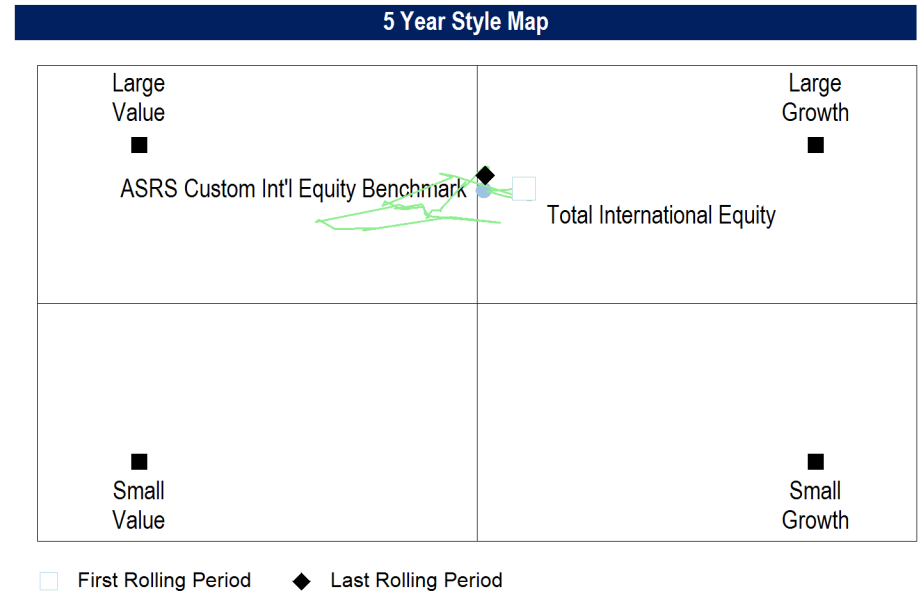
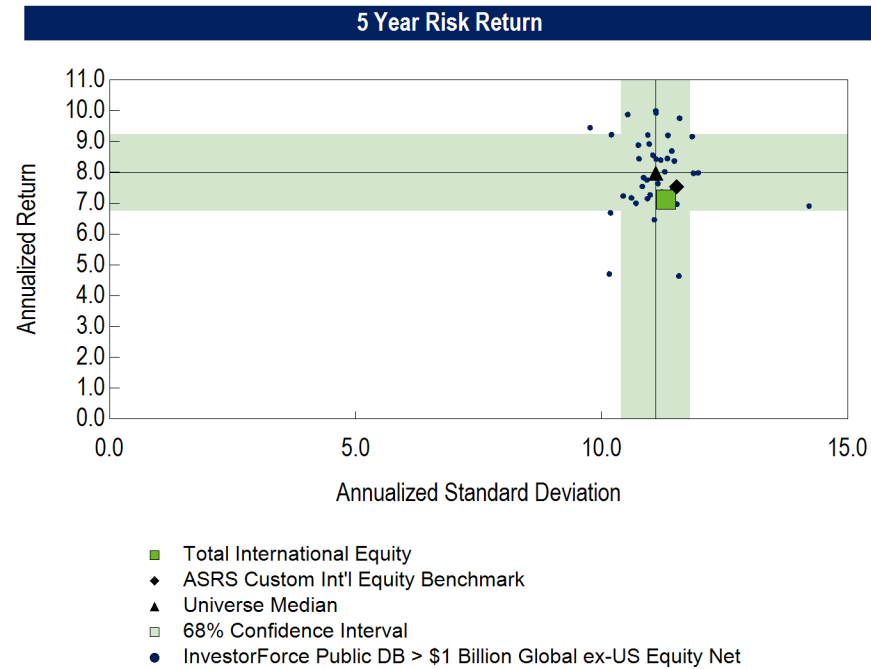
3 Year Style Map



- First Rolling Period
- ◆ Last Rolling Period

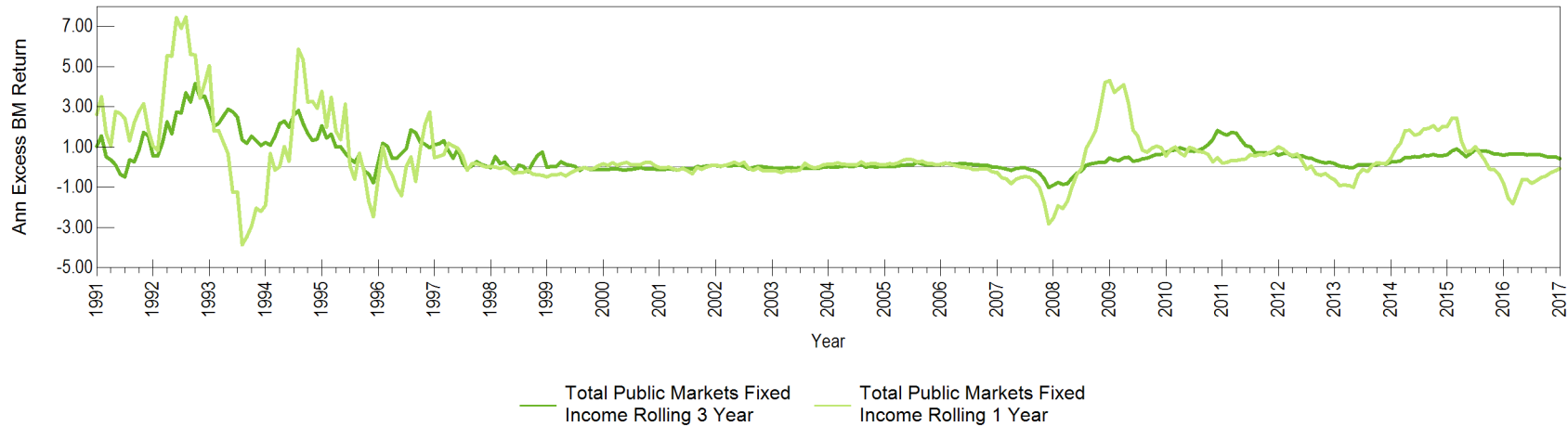


ASSET CLASS ANALYSIS - TOTAL INTERNATIONAL EQUITY

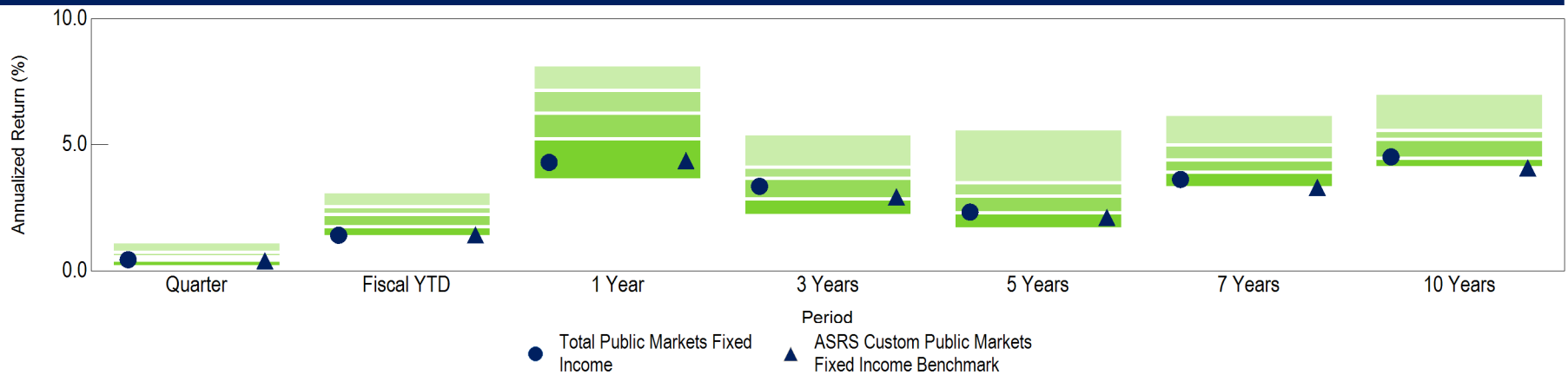


ASSET CLASS ANALYSIS - TOTAL PUBLIC MARKETS FIXED INCOME

Rolling Annual Excess Benchmark Return

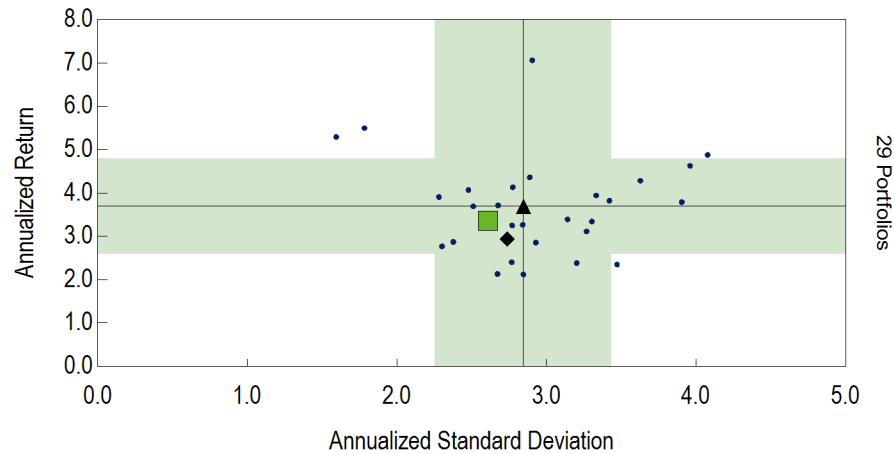


InvestorForce Public DB > \$1 Billion Fixed Income Net Accounts



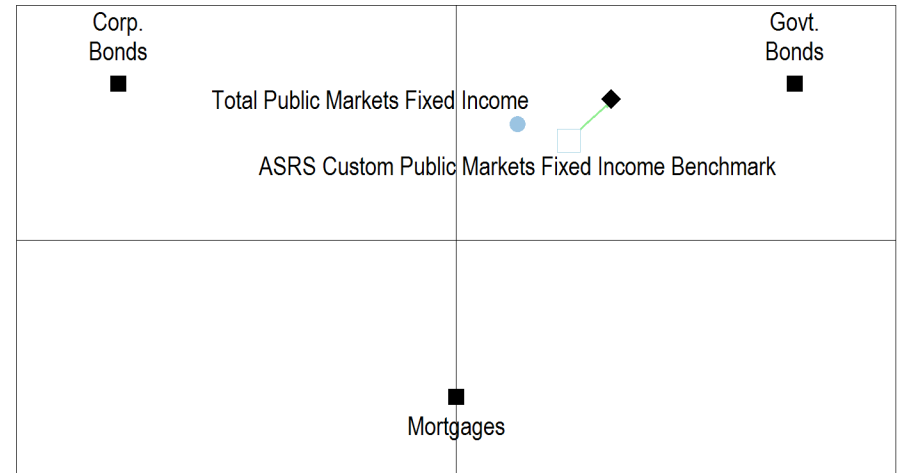
ASSET CLASS ANALYSIS - TOTAL PUBLIC MARKETS FIXED INCOME

3 Year Risk Return

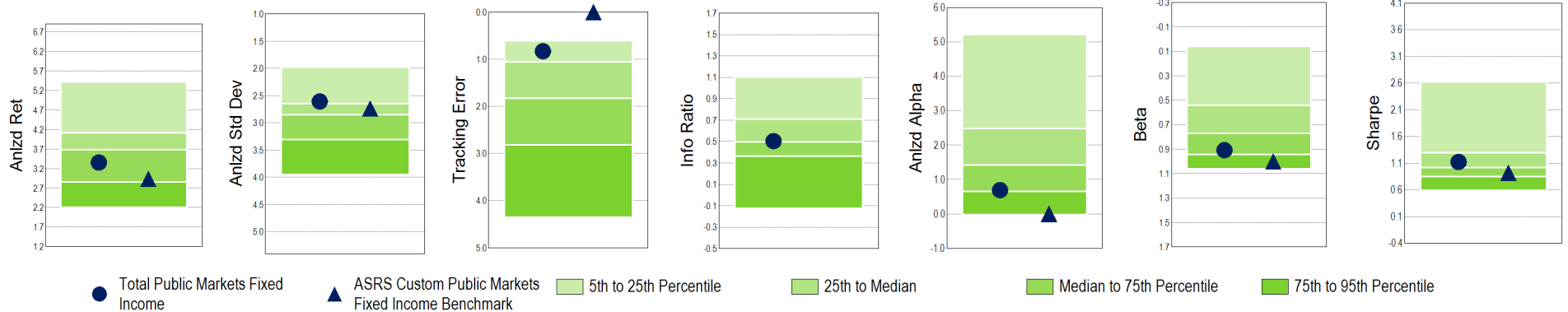


- Total Public Markets Fixed Income
- ◆ ASRS Custom Public Markets Fixed Income Benchmark
- ▲ Universe Median
- 68% Confidence Interval
- InvestorForce Public DB > \$1 Billion Fixed Income Net

3 Year Style Map

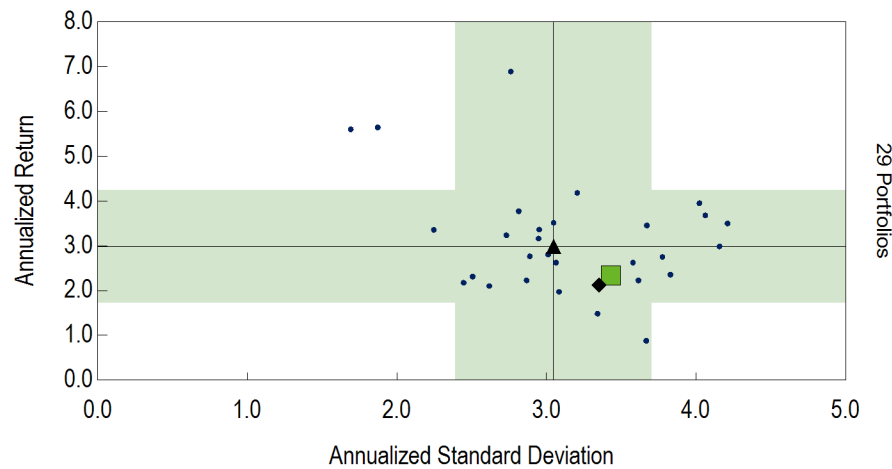


- First Rolling Period
- ◆ Last Rolling Period



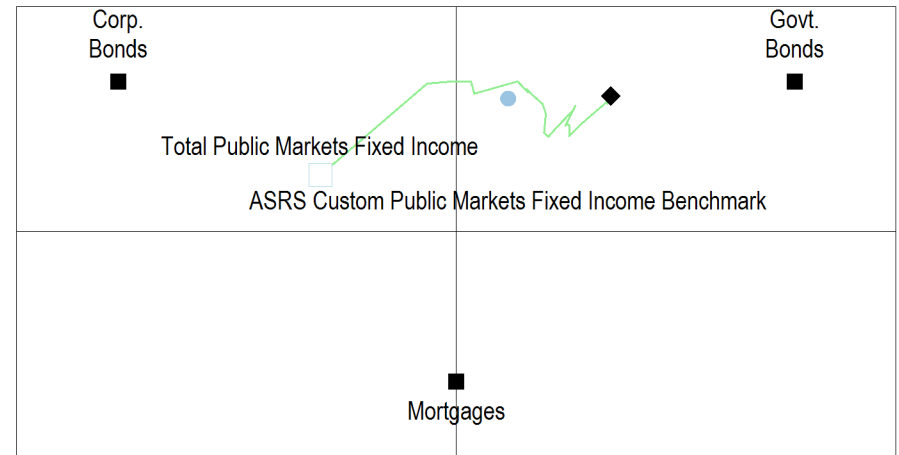
ASSET CLASS ANALYSIS - TOTAL PUBLIC MARKETS FIXED INCOME

5 Year Risk Return

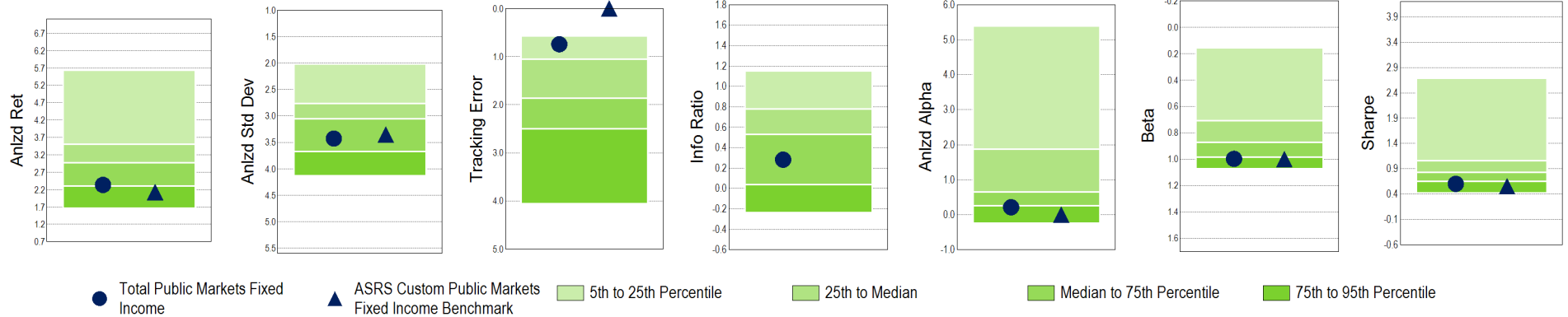


- Total Public Markets Fixed Income
- ◆ ASRS Custom Public Markets Fixed Income Benchmark
- ▲ Universe Median
- 68% Confidence Interval
- InvestorForce Public DB > \$1 Billion Fixed Income Net

5 Year Style Map

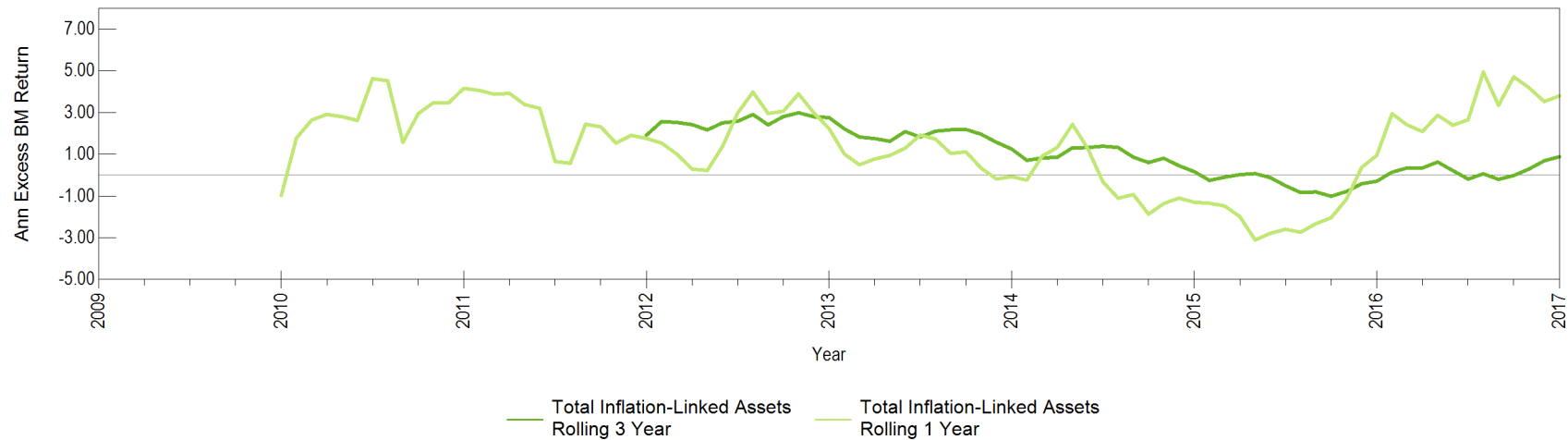


- First Rolling Period
- ◆ Last Rolling Period

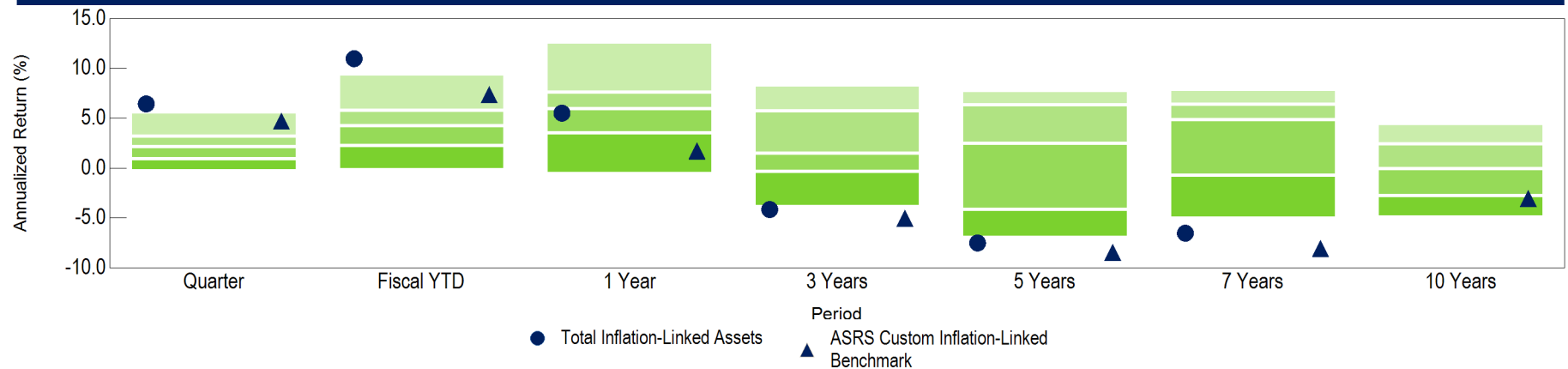


ASSET CLASS ANALYSIS - TOTAL INFLATION-LINKED ASSETS

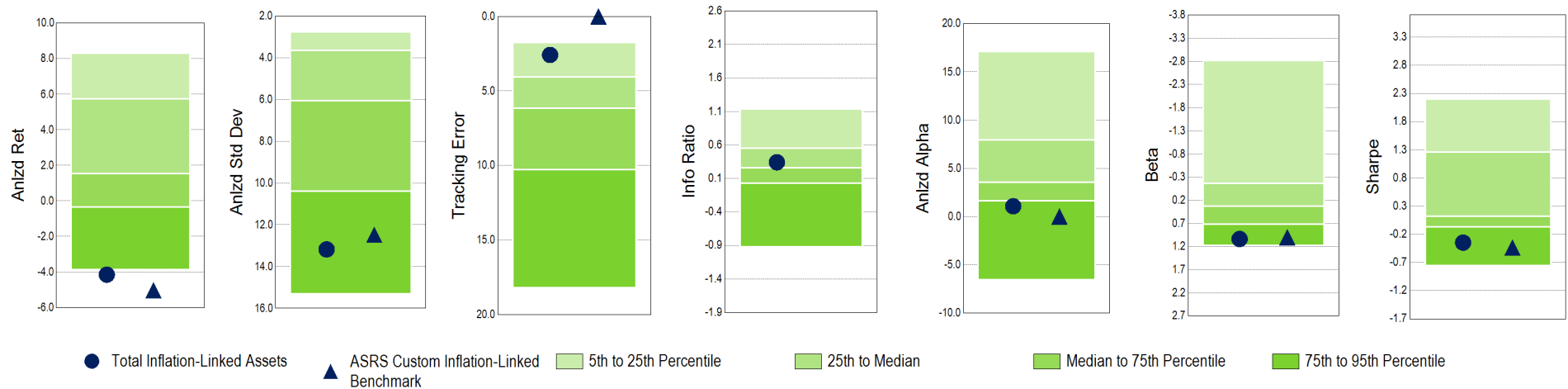
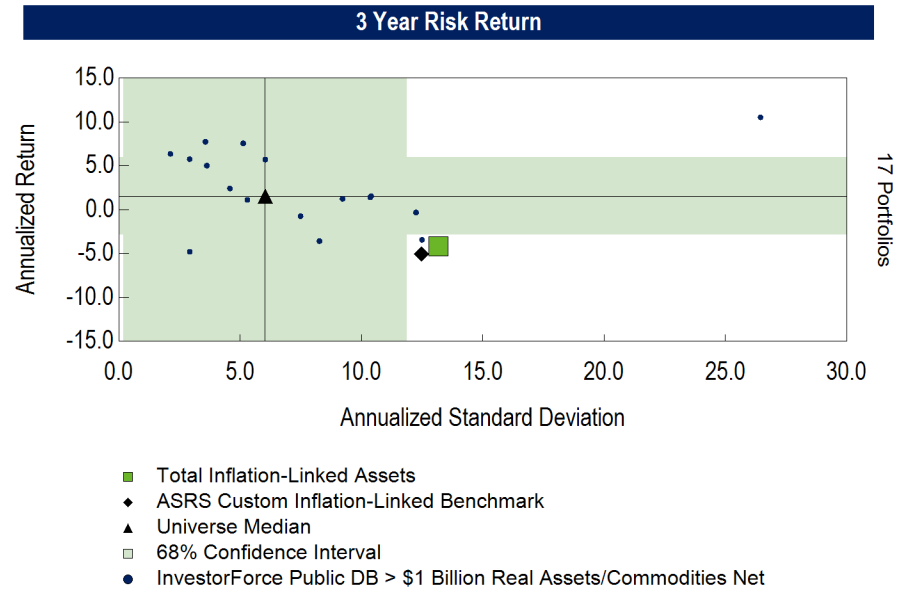
Rolling Annual Excess Benchmark Return



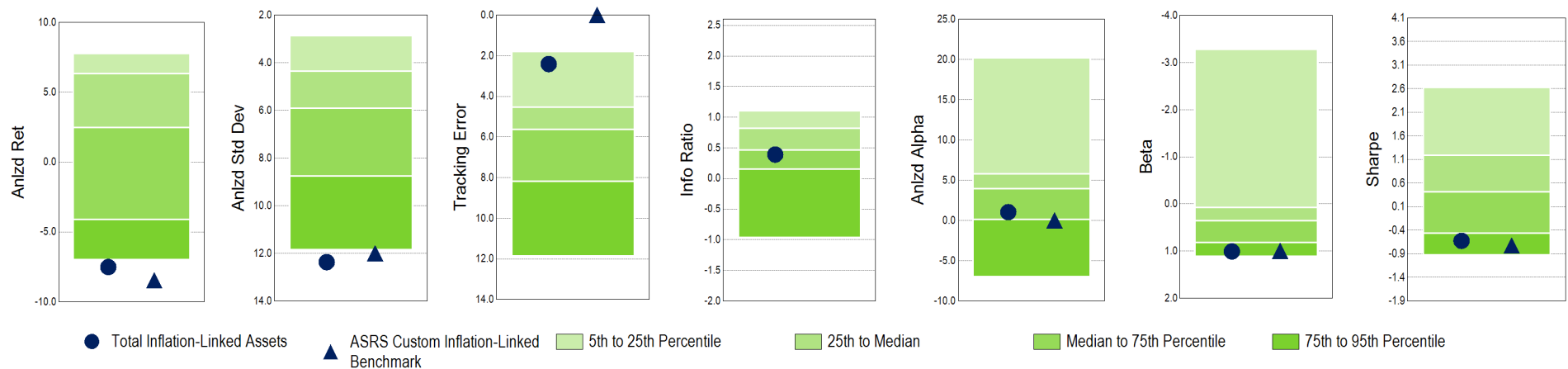
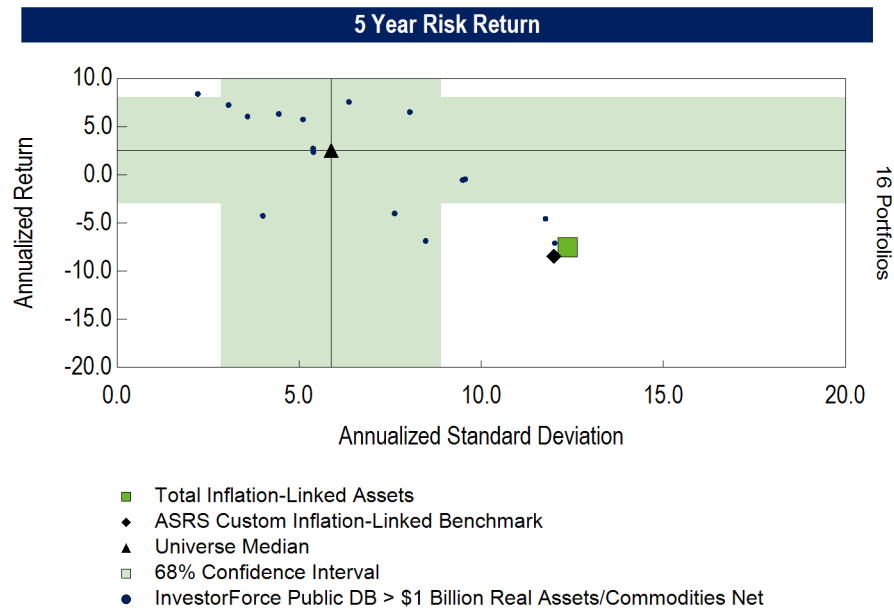
InvestorForce Public DB > \$1 Billion Real Assets/Commodities Net Accounts



ASSET CLASS ANALYSIS - TOTAL INFLATION-LINKED ASSETS

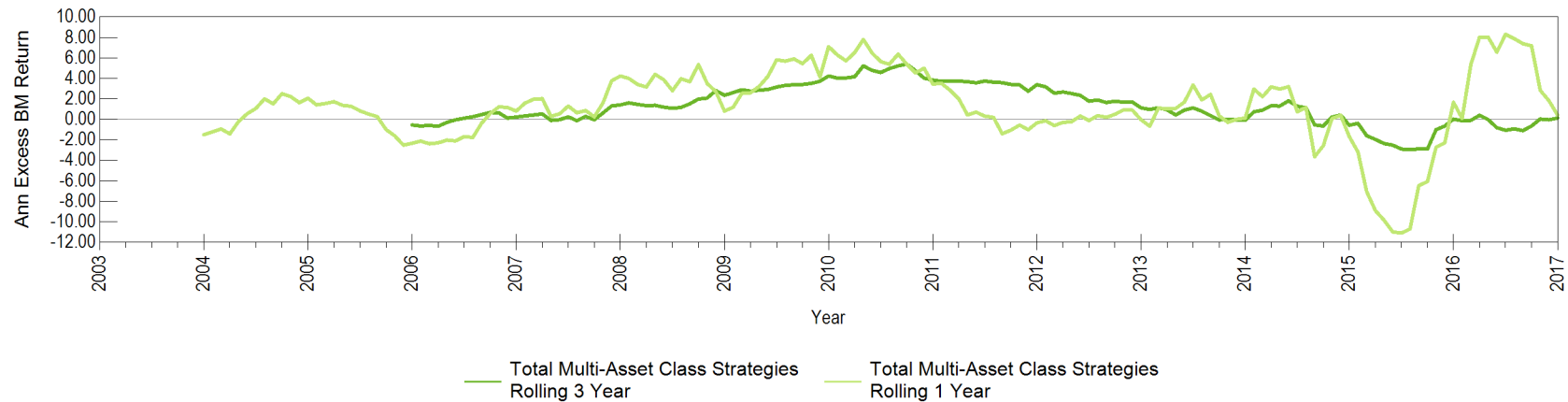


ASSET CLASS ANALYSIS - TOTAL INFLATION-LINKED ASSETS



ASSET CLASS ANALYSIS - TOTAL MULTI-ASSET CLASS STRATEGIES

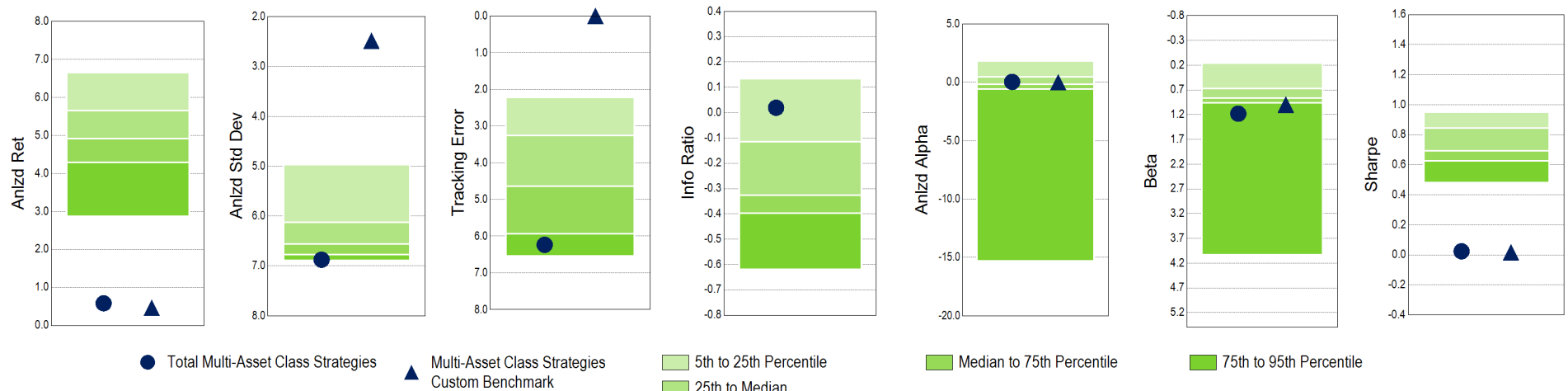
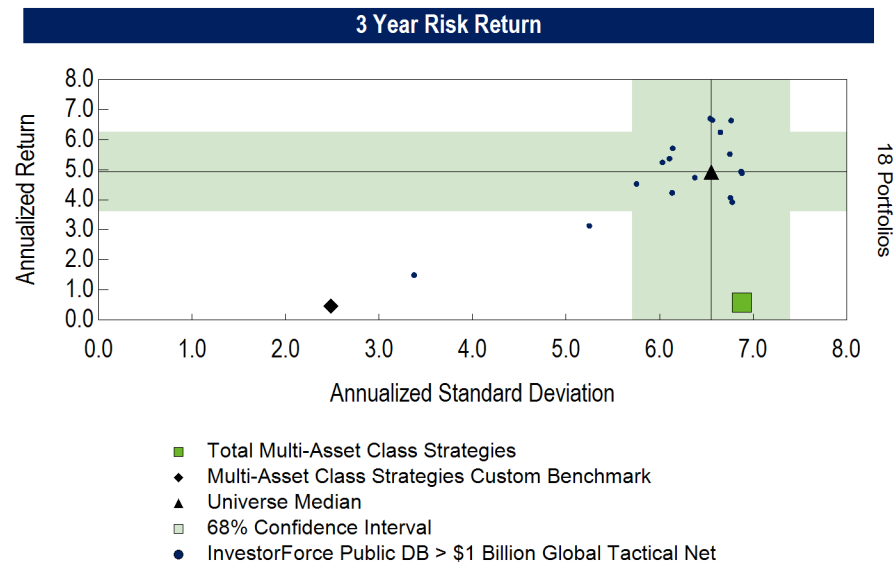
Rolling Annual Excess Benchmark Return



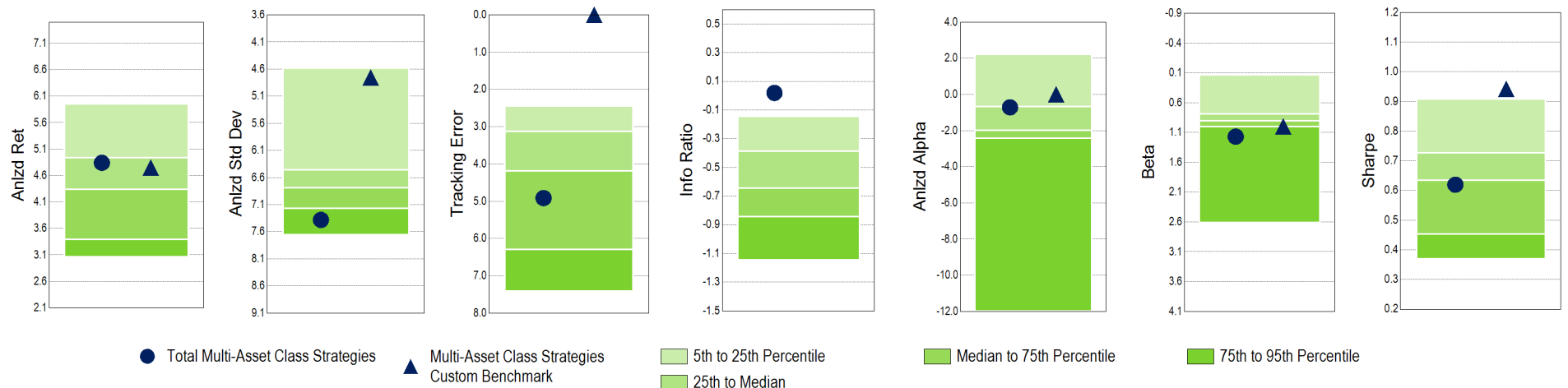
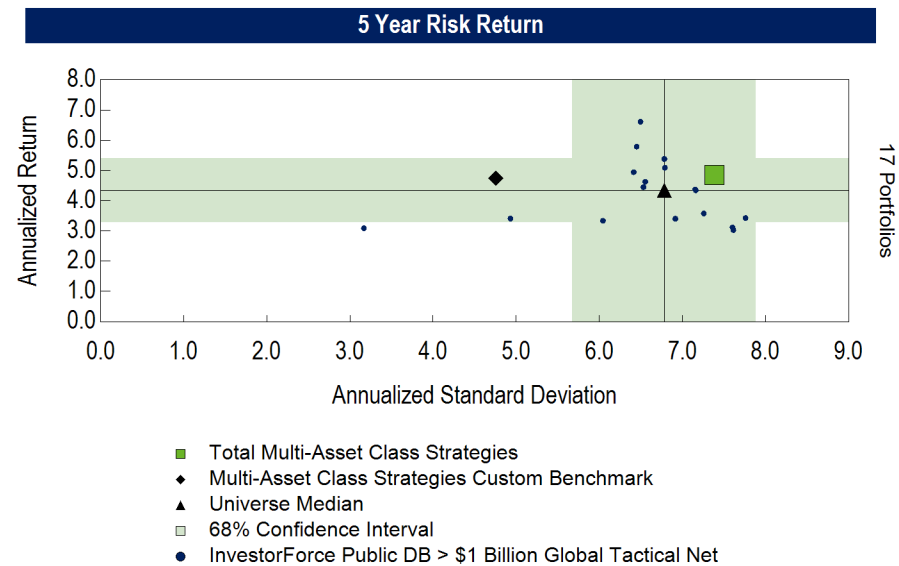
InvestorForce Public DB > \$1 Billion Global Tactical Net Accounts



ASSET CLASS ANALYSIS - TOTAL MULTI-ASSET CLASS STRATEGIES



ASSET CLASS ANALYSIS - TOTAL MULTI-ASSET CLASS STRATEGIES



ASSET CLASS COMMITTEE MEETING

- **Four Asset Class Committee meetings have been held since the last time we provided an update on the ASRS Asset Class Committee Meetings.**
- **November 30, 2017 – Combined Public and Private Markets Committee**
 - Public and private markets monthly report review and deal flow discussion
 - Real Estate manager recommendation
 - Outside consultant recommendation to sell an asset in the real estate portfolio
 - Committee approved the recommendation
 - Private Debt manager recommendation (\$100mm)
 - IMD recommendation to expand commitment with a current manager
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation
 - Review of Public Equity transition
 - Tools and outcomes reviewed with outside consultant
- **December 21, 2017 – Combined Public and Private Markets Committee**
 - Private Debt manager recommendation (\$100mm)
 - IMD recommendation to expand commitment with an existing investment manager
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation
 - Private Debt manager recommendation (\$100mm)
 - IMD recommendation to expand commitment with an existing investment manager
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation



ASSET CLASS COMMITTEE MEETING

- **January 18, 2018 – Combined Public and Private Markets Committee**

- Real Estate manager recommendation
 - Outside consultant recommendation to initiate diligence on a prospective investment
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation
- Vendor recommendation
 - IMD recommendation to expand an administrative vendor relationship
 - Committee approved the recommendation

- **February 5, 2018 – Combined Public and Private Markets Committee**

- Private markets monthly report and risk report review and deal flow discussion
- Real Estate manager recommendation (\$200mm)
 - Outside consultant recommendation to commit capital to a new investment manager relationship
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation
- Real Estate manager recommendation (\$30mm)
 - Outside consultant recommendation to commit capital to a existing investment manager relationship
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation



GENERAL OBSERVATIONS

- **The Fund continues to make significant progress moving the portfolio from the Interim SAAP toward the long-term SAAP**
 - Current Interim SAAP includes proration of 1% unfunded Private Debt as commitment and investment pace continues. Interim SAAP Private Debt allocation raised to 12% effective 4/1/2017.
 - Interim SAAP has achieved SAAP weight in Real Estate and Public Equity as of Q3 2016
 - Continued build out of private markets asset classes provides opportunity to take advantage of illiquidity premium to produce expected returns in excess of what we believe can be achieved in the public markets
- **The active manager Public Equity program has contributed negatively to performance over the past five years**
 - Recent restructuring efforts have focused on enhanced passive and factor based strategies
- **The Fixed Income program has contributed positively to performance over the past five years.**
 - \$2.4 billion in remaining commitments to private debt strategies equates to approximately 15% (NAV + unfunded) of Total Fund assets vs. the SAAP target of 12%
- **Real Estate contributing positively to relative performance over the past five years.**
- **Private Equity program has contributed negatively on a relative basis to performance over the past five years.**
 - Strong public markets performance is driving the negative contribution
- **Current tactical positioning is consistent with IMD House Views.**



INDEPENDENT OVERSIGHT/COMPLIANCE: LTD

Note: All of the data shown on the following pages is as of December 31, 2017 and reflects the deduction of investment manager fees, unless otherwise noted.

NEPC, LLC

LONG TERM DISABILITY PERFORMANCE

	Quarter	1 Year	3 Years	5 Years	10 Years	Since Inception (July-02)
Long Term Disability	3.5%	14.9%	7.2%	9.0%	5.6%	6.8%
LTD SAA Policy ¹	3.8%	15.6%	7.5%	8.9%	5.8%	7.1%
Excess Return	-0.3%	-0.7%	-0.3%	0.1%	-0.2%	-0.3%



¹LTD SAA Policy composition can be found in the appendix.

MARKET ENVIRONMENT UPDATE AND OUTLOOK

NEPC, LLC

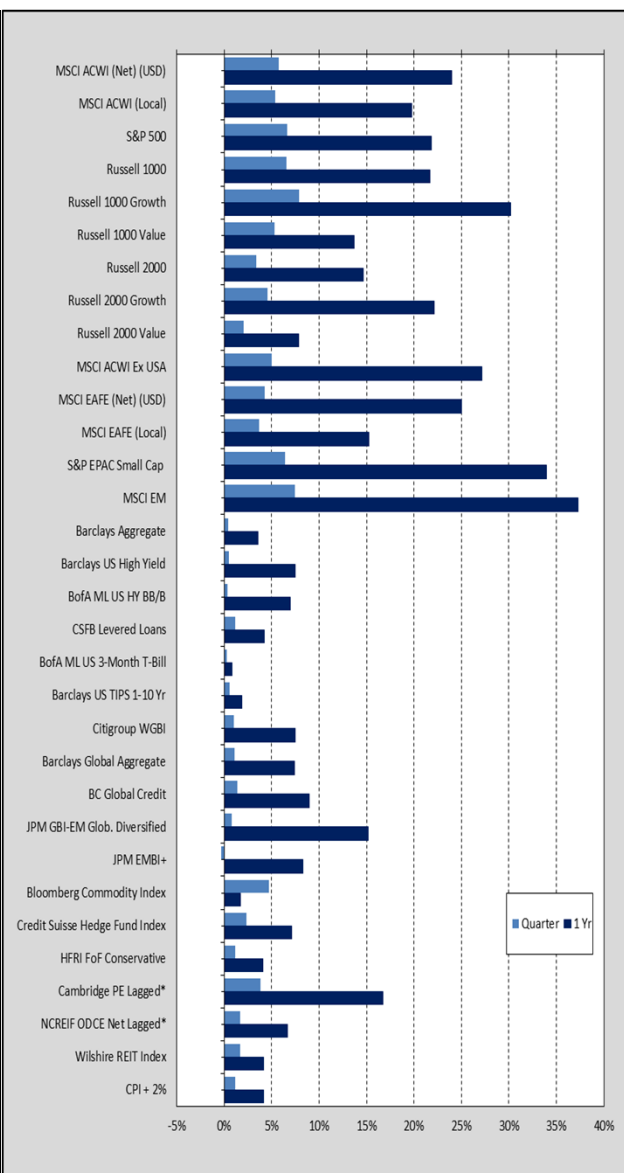
ECONOMIC ENVIRONMENT

- **Fourth quarter GDP growth rate (advance estimate) increased at a modest 2.6%.**
 - Retail sales ended December at +5.6% on a YoY basis. In the same period last year the YoY growth rate was 3.9%.
 - Corporate profits (ended July) as a percent of GDP increased slightly to 9.53% from 9.5% (in April) and remain elevated relative to historical levels.
 - The inventory-to-sales ratio ended November down at 1.3 from 1.4 and has remained relatively flat since early 2010.
 - The U.S. trade deficit widened by 2.3% ended November as imports increased.
- **The unemployment rate decreased to 4.1% from 4.2% in Q4; U-6, a broader measure of unemployment, decreased to 8.1% from 8.3% during the fourth quarter.**
- **The Case-Shiller Home Price Index (ended October) increased to 195.6 from 194.1 and remains at levels higher than that of pre-financial crisis levels of 150.9.**
- **Rolling 12-month seasonally-adjusted CPI saw a down-tick to 2.1% at the end of December from 2.2% at the end of September; Capacity Utilization marginally increased to 77.9% in Q4 from 76.1% in Q3.**
- **Fed Funds rate was increased to a targeted range of 1.25% - to – 1.50%. The 10-year Treasury Yield (constant maturity) finished Q4 at 2.4%, up from 2.2% in September.**
- **The Fed balance sheet decreased slightly during Q4 2017, while the European Central Bank balance sheet continues to increase.**
 - ECB held its benchmark refinancing rate at 0%, deposit rates -0.4% and asset purchases would slow from €60 billion per month to €30 billion per month.
- **S&P valuations increased slightly in Q4 remaining above the 10-year and long-term averages.**
 - Cyclically adjusted Shiller PE ratio (32.5x) is above the long-term average of 16.8x and above the 10-year average of 23.3x.



MARKET ENVIRONMENT – Q4 2017 OVERVIEW

		Qtr.	1 Yr.	3 Yr.	5 Yr.	10 Yr.
World Equity Benchmarks						
MSCI ACWI (Net) (USD)	World	5.7%	24.0%	9.3%	10.8%	4.7%
MSCI ACWI (Local)	World (Local Currency)	5.3%	19.8%	9.7%	12.6%	5.4%
Domestic Equity Benchmarks						
S&P 500	Large Core	6.6%	21.8%	11.4%	15.8%	8.5%
Russell 1000	Large Core	6.6%	21.7%	11.2%	15.7%	8.6%
Russell 1000 Growth	Large Growth	7.9%	30.2%	13.8%	17.3%	10.0%
Russell 1000 Value	Large Value	5.3%	13.7%	8.7%	14.0%	7.1%
Russell 2000	Small Core	3.3%	14.6%	10.0%	14.1%	8.7%
Russell 2000 Growth	Small Growth	4.6%	22.2%	10.3%	15.2%	9.2%
Russell 2000 Value	Small Value	2.0%	7.8%	9.5%	13.0%	8.2%
International Equity Benchmarks						
MSCI ACWI Ex USA	World ex-US	5.0%	27.2%	7.8%	6.8%	1.8%
MSCI EAFE (Net) (USD)	Int'l Developed	4.2%	25.0%	7.8%	7.9%	1.9%
MSCI EAFE (Local)	Int'l Developed (Local Currency)	3.7%	15.2%	8.5%	11.4%	3.3%
S&P EPAC Small Cap	Small Cap Int'l	6.4%	34.0%	14.1%	13.1%	5.6%
MSCI EM	Emerging Equity	7.4%	37.3%	9.1%	4.3%	1.7%
Domestic Fixed Income Benchmarks						
Barclays Aggregate	Core Bonds	0.4%	3.5%	2.2%	2.1%	4.0%
Barclays US High Yield	High Yield	0.5%	7.5%	6.4%	5.8%	8.0%
BofA ML US HY BB/B	High Yield	0.4%	7.0%	6.0%	5.6%	7.3%
CSFB Levered Loans	Bank Loans	1.2%	4.2%	4.5%	4.3%	4.6%
BofA ML US 3-Month T-Bill	Cash	0.3%	0.9%	0.4%	0.3%	0.4%
Barclays US TIPS 1-10 Yr	Inflation	0.5%	1.9%	1.8%	0.1%	2.8%
Global Fixed Income Benchmarks						
Citigroup WGBI	World Gov. Bonds	1.0%	7.5%	1.7%	0.1%	2.7%
Barclays Global Aggregate	Global Core Bonds	1.1%	7.4%	2.0%	0.8%	3.1%
BC Global Credit	Global Bonds	1.3%	8.9%	2.9%	2.3%	4.1%
JPM GBI-EM Glob. Diversified	Em. Mkt. Bonds (Local Currency)	0.8%	15.2%	2.5%	-1.5%	3.6%
JPM EMBI+	Em. Mkt. Bonds	-0.3%	8.3%	6.5%	3.3%	6.8%
Alternative Benchmarks						
Bloomberg Commodity Index	Commodities	4.7%	1.7%	-5.0%	-8.5%	-6.8%
Credit Suisse Hedge Fund Index	Hedge Fund	2.3%	7.1%	2.5%	4.3%	3.2%
HFRI FoF Conservative	Fund of Hedge Funds	1.1%	4.1%	2.1%	3.4%	0.9%
Cambridge PE Lagged*	Private Equity	3.8%	16.7%	10.4%	13.3%	9.6%
NCREIF ODCE Net Lagged*	Real Estate	1.6%	6.7%	9.8%	10.6%	4.1%
Wilshire REIT Index	REIT	1.7%	4.2%	5.2%	9.3%	7.3%
CPI + 2%	Inflation/Real Assets	1.1%	4.2%	3.6%	3.4%	3.6%



* As of 9/30/2017



MARKET ENVIRONMENT

Global Equity

- **U.S. equities as measured by the S&P 500 posted strong gains in the fourth quarter (+6.6%).**
- **Small cap stocks underperformed large cap stocks during the quarter, with the Russell 2000 Index returning 3.3% and the Russell 1000 Index returning 6.6%.**
- **International equities underperformed U.S. markets during the quarter, returning 5.0%, as measured by the MSCI ACWI ex-U.S. Index. Emerging markets returned 7.4% as measured by the MSCI Emerging Markets Index in U.S. dollar terms.**
 - Developed international markets returned 4.2% in USD terms, while in local currency terms returned 3.7% as measured by the MSCI EAFE Index.

Private Equity

- **Capital commitment momentum slowed in Q3 2017, however aggregate capital raised has risen versus last year and was dominated by the five largest investment vehicles.**
- **Private equity fundraising totaled \$95 billion in Q3 2017.**
 - North America focused private equity funds raised \$64 billion.
 - Asia focused private equity funds raised \$9.4 billion.
 - Europe focused private equity raised \$20 billion.
- **Private equity dry powder continued its increase to record levels and stands at \$954 billion.**



MARKET ENVIRONMENT

Fixed Income

- The nominal yield curve continued to flatten in Q4. Long term yields decreased 5 –to- 12 basis points across 20 to 30 year treasury bonds while short term yields increased 33 basis points for the 3 month and 45 basis points in the one year.
- The spread between two and 10 year rates decreased to 51 basis points from 86 basis points in Q4.
- Treasury Inflation-Protected Securities, or TIPS, returned 0.5% during the quarter, as measured by the BBg Barclays US TIPS 1-10 Yr Index.
- The BBg Barclays Long Duration Credit Index gained 3.16%.
- Long Treasuries gained 2.37% and investment-grade US corporate debt gained 0.4%.
- The BBg Barclays 1-3 year US Government/ Credit Index returned -0.21%. US high yield bonds gained 0.5% as spreads compressed.
- **Emerging markets debt had mixed results.**
 - US dollar-denominated debt, as measured by the JP Morgan EMBI Index, returned -0.3%; local currency debt gained 0.8%, according to the JP Morgan GBI-EM BD Index.



MARKET ENVIRONMENT

Real Assets/Inflation-Linked Assets

- **Energy remains attractive despite volatile oil prices.**
 - Private equity and debt opportunities are attractive.
 - Fire sale prices never materialized but focusing on assets outside of the hottest zip codes provides potential for strong returns as market normalizes.
- **Infrastructure – select opportunities to access growth markets.**
 - High quality assets are receiving premium bids from direct investors (Pension Funds and Sovereigns) with low costs of capital and long hold horizons; focus on mismanaged or niche opportunities.
- **Metals & Mining – have commodity prices bottomed?**
 - Improving Metals & Mining fundamentals but limited to assets near production
- **Timber – low return potential and limited opportunity for outperformance.**
- **Agriculture – near-term slowdown in price appreciation creates opportunity to invest in a strong (very) long term outlook supported by demographic trends.**



MARKET ENVIRONMENT

Commodities

- **Commodities gained 4.7% as measured by the Bloomberg Commodity Index.**
 - US Dollar weakness led to stronger commodity prices broadly.

Real Estate

- **NEPC continues to be neutral on core real estate in the US and remains positive on non-core real estate, that is, value-add and opportunistic strategies.**
- **Real estate fundamentals (rent growth, occupancy, net absorption) remain strong; however, valuations are high on an absolute and relative basis.**
 - Rising interest rates have been baked into existing valuations but excess cap rate expansion (beyond general expectations) will reset valuations.
 - REIT sector has been volatile and remain at the high end of historical FFO multiple ranges
- **Overall, the non-core real estate investment environment in the U.S. is normalizing; however, select areas remain attractive.**
- **Europe is viewed as the best place for a marginal dollar of non-core real estate investment.**
- **Emerging markets in Latin America (Brazil) and Asia (China, India) may have strengthening opportunities.**



APPENDIX: SAA POLICY HISTORY

NEPC, LLC

STRATEGIC ASSET ALLOCATION POLICY HISTORY

- 7/1/75 – 12/31/79 – 40% S&P 500/60% Barclays Capital Aggregate
- 1/1/80 – 12/31/83 – 50% S&P 500/50% Barclays Capital Aggregate
- 1/1/84 – 12/31/91 – 60% S&P 500/40% Barclays Capital Aggregate
- 1/1/92 – 12/31/94 – 50% S&P 500/10% MSCI EAFE/40% Barclays Capital Aggregate
- 1/1/95 – 6/30/97 – 45% S&P 500/15% MSCI EAFE/40% Barclays Capital Aggregate
- 7/1/97 – 12/31/99 – 50% S&P 500/15% MSCI EAFE/35% Barclays Capital Aggregate
- 1/1/00 – 9/30/03 – 53% S&P 500/17% MSCI EAFE/30% Barclays Capital Aggregate
- 10/1/03 – 12/31/06 – 53% S&P 500/15% MSCI EAFE/ACWI ex-U.S.¹/26% Barclays Capital Aggregate/6% NCREIF ODCE (lagged one quarter)
- 1/1/07 – 10/31/2009 – 31% S&P 500/7% S&P 400/7% S&P 600/18% MSCI ACWI ex-U.S./5% Russell 2000 (lagged one quarter)/26% Barclays Capital Aggregate/6% NCREIF ODCE (lagged one quarter)
- 11/1/2009 – 6/30/2012 – 28% S&P 500/6% S&P 400/6% S&P 600/13% MSCI EAFE/2% MSCI EAFE Small Cap/3% MSCI Emerging Markets/7% Russell 2000 (lagged one quarter)/24% Barclays Capital Aggregate/2% Barclays Capital High Yield/6% NCREIF ODCE (lagged one quarter)/3% Dow Jones/UBS Commodities Index
- 7/1/2012 – 3/31/2015 – 23% S&P 500/5% S&P 400/5% S&P 600/14% MSCI EAFE/3% MSCI EAFE Small Cap/6% MSCI Emerging Markets/7% Russell 2000 (lagged one quarter)/13% Barclays Capital Aggregate/5% Barclays Capital High Yield/4% JP Morgan GBI-EM Global Diversified/3% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/8% NCREIF ODCE (lagged one quarter)/4% Dow Jones/UBS Commodities Index
- 4/1/2015 – 3/31/2017 – 20% S&P 500/3% S&P 400/3% S&P 600/17% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/8% Russell 2000 (lagged one quarter)/11% Barclays Capital Aggregate/4% Barclays Capital High Yield/10% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/10% NCREIF ODCE (lagged one quarter)/2% Bloomberg Commodities Index TR/5% Multi-Asset Class Custom Index
- **4/1/2017 - present – 20% S&P 500/3% S&P 400/3% S&P 600/17% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/8% Russell 2000 (lagged one quarter)/11% Barclays Capital Aggregate/2% Barclays Capital High Yield/12% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/10% NCREIF ODCE (lagged one quarter)/2% Bloomberg Commodities Index TR/5% Multi-Asset Class Custom Index**
- ***Interim SAA Policy:** 20% S&P 500/3% S&P 400/3% S&P 600/17% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/8% Russell 2000 (lagged one quarter)/12% Barclays Capital Aggregate/2% Barclays Capital High Yield/11% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/2% Bloomberg Commodity Index/5% Multi-Asset Class Custom Index/10% NCREIF ODCE (lagged one quarter)
- Note: Interim SAA Policy includes proration of 1% Private Debt which is unfunded. Recently approved Strategic Asset Allocation Policy effective April 1, 2017.

¹MSCI EAFE/ACWI ex-U.S. Benchmark is the MSCI EAFE Index prior to 10/1/2005 and the MSCI ACWI ex-U.S. thereafter.

Note: All MSCI indices changed from Gross to Net dividend withholding taxes effective 1/1/2014.



CUSTOM ASSET CLASS BENCHMARK HISTORY

- **ASRS Custom Total Equity Benchmark** was 77% S&P 500, 23% MSCI EAFE through 12/31/1999; 76% S&P 500, 24% MSCI EAFE through 9/30/2003; 78% S&P 500, 22% MSCI EAFE/ACWI ex-U.S.¹ through 12/31/2006; 49% S&P 500, 11% S&P 400, 11% S&P 600, 29% MSCI ACWI ex-U.S. through 10/31/2009; 48% S&P 500, 10% S&P 400, 10% S&P 600, 23% MSCI EAFE, 4% MSCI EAFE Small Cap, 5% MSCI Emerging Markets through 6/30/2012; 41% S&P 500, 9% S&P 400, 9% S&P 600, 25% MSCI EAFE, 5% MSCI EAFE Small Cap, 11% MSCI Emerging Markets through 3/31/2015; 40% S&P 500, 6% S&P 400, 6% S&P 600, 34% MSCI EAFE, 4% MSCI EAFE Small Cap, 10% MSCI Emerging Markets thereafter.
- **ASRS Custom Domestic Equity Benchmark** was S&P 500 through 12/31/2006; 74% S&P 500, 13% S&P 400, 13% S&P 600 through 12/31/2010; 70% S&P 500, 15% S&P 400, 15% S&P 600 through 3/31/2015.; 77% S&P 500, 11.5% S&P 400, 11.5% S&P 600 thereafter.
- **ASRS Custom International Equity Benchmark** was MSCI EAFE through 9/30/2005; MSCI ACWI ex-U.S. through 12/31/2010; 72% MSCI EAFE, 11% MSCI EAFE Small Cap and 17% MSCI Emerging Markets through 6/30/2012; 61% MSCI EAFE, 13% MSCI EAFE Small Cap and 26% MSCI Emerging Markets through 3/31/2015; 71% MSCI EAFE, 8% MSCI EAFE Small Cap and 21% MSCI Emerging Markets thereafter.
- **ASRS Custom Public Markets Fixed Income Benchmark** was Barclays Capital U.S. Aggregate Index through 12/31/2010; 93% Barclays Capital U.S. Aggregate Index, 7% Barclays Capital U.S. High Yield Bond Index through 12/31/2012; 59% Barclays Capital U.S. Aggregate Index, 23% Barclays Capital U.S. High Yield Bond Index, 18% JP Morgan GBI-EM Global Diversified through 3/31/2015; 73% Barclays Capital U.S. Aggregate Index, 27% Barclays Capital U.S. High Yield Bond Index through 3/31/2017; 85% Barclays Capital U.S. Aggregate Index, 15% Barclays Capital U.S. High Yield Bond Index thereafter.
- **ASRS Custom Inflation-Linked Benchmark** was 100% Barclays Capital U.S. TIPS through 7/31/2010; 50% Barclays Capital U.S. TIPS, 50% Bloomberg Commodity Index through 8/31/2010; 30% Barclays Capital U.S. TIPS, 70% Bloomberg Commodity Index through 5/31/2011; 100% Bloomberg Commodity Index thereafter.
- **Multi-Asset Class Strategies Custom Benchmark** was 56% S&P 500, 16% MSCI EAFE, 28% Barclays Capital Aggregate through 9/30/2011; 50% S&P 500, 19% MSCI EAFE, 28% Barclays Capital Aggregate, and 3% Bloomberg Commodity Index through 06/30/2012; 43% S&P 500, 25% MSCI EAFE, 28% Barclays Capital Aggregate, and 4% Bloomberg Commodity Index through 3/31/2015; market value weighted average of the benchmarks for Bridgewater (91 Day T-Bill) and Windham (52% MSCI ACWI net, 30% Citi WGBI, 9% DJ US REIT, and 9% Bloomberg Commodities Index) thereafter.

¹MSCI EAFE/ACWI ex-U.S. Benchmark is the MSCI EAFE Index prior to 10/1/2005 and the MSCI ACWI ex-U.S. thereafter.

Note: All MSCI indices changed from Gross to Net of dividend withholding taxes effective 1/1/2014.



CUSTOM ASSET CLASS BENCHMARK HISTORY

- **ASRS Custom Small Cap Equity Blended Benchmark** was the Russell 2000 Index through 12/31/2006; S&P 600 Index thereafter.
- **ASRS Custom Int'l Developed Markets Equity Index** was MSCI EAFE through 9/30/2005; MSCI ACWI ex-U.S. through 12/31/2010; 87% MSCI EAFE and 13% MSCI EAFE Small Cap through 6/30/2012; 82% MSCI EAFE and 18% MSCI EAFE Small Cap through 3/31/2015; 89% MSCI EAFE and 11% MSCI EAFE Small Cap thereafter.
- **Brandes Custom Benchmark** was MSCI EAFE through 9/30/2005; MSCI ACWI ex-U.S. through 2/28/2011; MSCI EAFE thereafter.
- **ASRS Cash Assetization Custom Benchmark** is 33% S&P 500, 14% Russell 2000, 25% MSCI EAFE, 28% Barclays Treasury Index through 8/24/2015; 100% Barclays US Long Treasury Index through 11/13/2015; 15% S&P 500, 15% Russell 2000, 16% MSCI EAFE, 4% MSCI Emerging Markets Index, 50% Barclays US Treasury Index through 4/29/2016; 52% S&P 500, 18% Russell 2000, 30% Barclays US Long Treasury Index through 6/28/2016; 100% Barclays US Long Treasury Index through 9/15/2016; NYSE US 2 Year Treasury Futures Index through 12/21/2016; 30% S&P 500, 10% Russell 2000, 30% MSCI EAFE, 30% Barclays Treasury Index thereafter.
- **ASRS Bridgewater Custom Benchmark** was 56% S&P 500, 16% MSCI EAFE, 28% Barclays Capital Aggregate through 9/30/2011; 50% S&P 500, 19% MSCI EAFE, 28% Barclays Capital Aggregate, and 3% Bloomberg Commodity Index through 06/30/2012; 43% S&P 500, 25% MSCI EAFE, 28% Barclays Capital Aggregate, and 4% Bloomberg Commodity Index through 3/31/2015; Citigroup 3-Month Treasury Bill Index thereafter.

¹MSCI EAFE/ACWI ex-U.S. Benchmark is the MSCI EAFE Index prior to 10/1/2005 and the MSCI ACWI ex-U.S. thereafter.

Note: All MSCI indices changed from Gross to Net of dividend withholding taxes effective 1/1/2014.



LONG TERM DISABILITY STRATEGIC ASSET ALLOCATION POLICY HISTORY

- 7/1/2002 – 12/31/2004 - 53% S&P 500/17% MSCI EAFE/30% Barclays Capital Aggregate Bond Index
- 1/1/2005 – 2/28/2007 - 53% Russell 3000/15% MSCI EAFE/26% Barclays Capital Aggregate Bond Index/6% DJ Wilshire Real Estate Securities Index
- 3/1/2007 – 12/31/2010 - 50% Russell 3000/18% MSCI EAFE/26% Barclays Capital Aggregate Bond Index/6% DJ Wilshire Real Estate Securities Index
- 1/1/2011 – 12/31/2012 - 40% Russell 1000/7% Russell 2000/13% MSCI EAFE/2% MSCI EAFE Small Cap/3% MSCI Emerging Markets/24% Barclays Capital Aggregate/2% Barclays Capital High Yield/6% DJ Wilshire Real Estate Securities Index/3% Bloomberg Commodity Index
- 1/1/2013 – 2/28/2016 - 34% Russell 1000/6% Russell 2000/14% MSCI EAFE/3% MSCI EAFE Small Cap/6% MSCI Emerging Markets/13% Barclays Capital Aggregate/8% Barclays Capital High Yield/4% JP Morgan GBI-EM Global Diversified/8% DJ Wilshire Real Estate Securities Index/4% Bloomberg Commodity Index
- 2/29/2016 – 7/26/2017 - 24% Russell 1000/12% Russell 2000/18% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/19% Barclays Capital Aggregate/7% Barclays Capital High Yield/11% DJ Wilshire Real Estate Securities Index/2% Bloomberg Commodity Index
- 7/27/2017 – **present** – **20% S&P 500/3% S&P 400/3% S&P 600/17% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/8% Russell 2000 (lagged one quarter)/11% Barclays Capital Aggregate/2% Barclays Capital High Yield/12% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/10% NCREIF ODCE (lagged one quarter)/2% Bloomberg Commodities Index TR/5% Multi-Asset Class Custom Index**
- ***Interim SAA Policy:** 20% S&P 500/3% S&P 400/3% S&P 600/17% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/8% Russell 2000 (lagged one quarter)/12% Barclays Capital Aggregate/2% Barclays Capital High Yield/11% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/2% Bloomberg Commodity Index/5% Multi-Asset Class Custom Index/10% NCREIF ODCE (lagged one quarter)



Note: All MSCI indices changed from Gross to Net of dividend withholding taxes effective 1/1/2014.

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