

# FUND EVALUATION REPORT

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## Worcester Retirement System

Meeting Materials  
December 12, 2019



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## **Third Quarter 2019 Performance Review**

## **Retirement System Summary**

PRIT Look Through Analysis  
Aggregate Assets  
As of September 30, 2019

	Actual Asset Allocation <sup>1,2</sup> (%)	PRIT Actual Asset Allocation <sup>1</sup> (%)
<b>Total Retirement System</b>		
<b>Global Equity Assets</b>	<b>42</b>	<b>42</b>
<i>Domestic Equity Assets</i>	20	22
<i>International Developed Market Equity Assets</i>	12	14
<i>International Emerging Market Equity Assets</i>	10	6
<b>Fixed Income Assets</b>	<b>24</b>	<b>23</b>
<i>Core Fixed Income Assets<sup>3</sup></i>	15	15
<i>Value-Added Fixed Income Assets<sup>4</sup></i>	9	8
<b>Real Estate Assets</b>	<b>10</b>	<b>9</b>
<b>Private Equity Assets</b>	<b>11</b>	<b>11</b>
<b>Portfolio Completion Strategies / Hedge Funds / GTAA</b>	<b>3</b>	<b>10</b>
<b>Real Assets (Natural Resources, Timber, Infrastructure)</b>	<b>9</b>	<b>4</b>
<b>Cash</b>	<b>&lt;1</b>	<b>1</b>

<sup>1</sup> Numbers may not sum to 100% due to rounding.

<sup>2</sup> Asset classes include a pro-rata allocation of the System's 31% holding of the PRIT Core Fund.

<sup>3</sup> Retirement System figures include investment grade bonds and TIPS.

<sup>4</sup> Retirement System figures include high yield fixed income and emerging market debt.



Worcester Retirement System  
Retirement System Summary

As of September 30, 2019

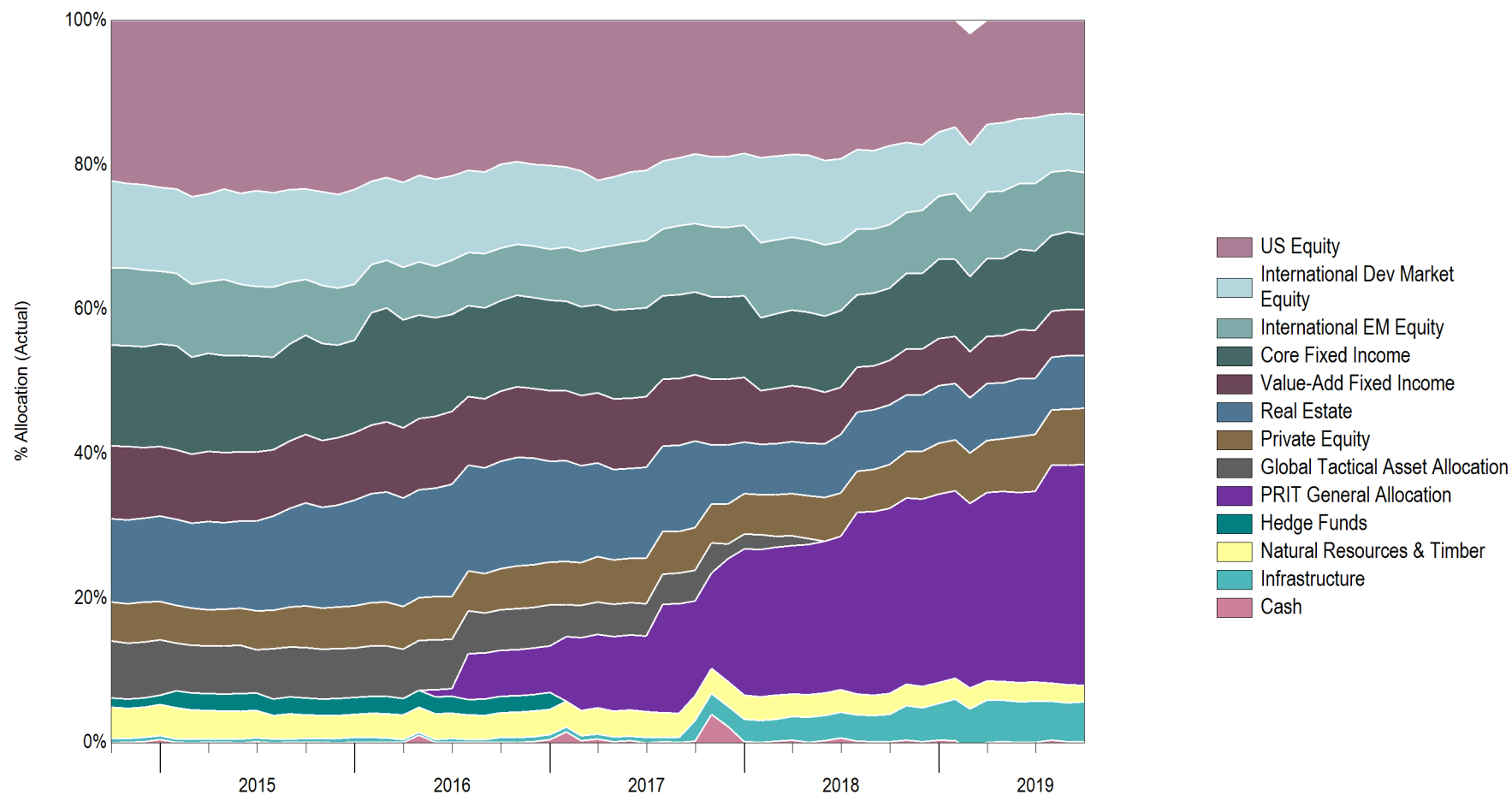
Allocation vs. Policy Targets

	Current Balance	Current Allocation	Policy	Policy Range	Within IPS Range?
US Equity	\$130,807,630	13%	14%	9% - 19%	Yes
International Dev Market Equity	\$80,456,137	8%	8%	4% - 12%	Yes
International EM Equity	\$86,013,666	9%	8%	4% - 12%	Yes
Core Fixed Income	\$104,390,127	10%	10%	5% - 15%	Yes
Value-Add Fixed Income	\$63,570,653	6%	4%	2% - 6%	No
Real Estate	\$73,353,658	7%	6%	4% - 8%	Yes
Private Equity	\$78,305,433	8%	7%	4% - 10%	Yes
PRIT General Allocation	\$306,011,838	31%	35%	0% - 50%	Yes
Natural Resources & Timber	\$23,461,078	2%	3%	1% - 5%	Yes
Infrastructure	\$55,044,796	5%	5%	2% - 8%	Yes
Cash	\$1,439,325	0%	0%	0% - 5%	Yes
<b>Total</b>	<b>\$1,002,854,338</b>	<b>100%</b>	<b>100%</b>		



As of September 30, 2019

Asset Allocation History  
5 Years Ending September 30, 2019



## Retirement System Summary

As of September 30, 2019

## Asset Class Performance Summary

	Market Value (\$)	% of Portfolio	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
<b>Total Retirement System</b>	<b>1,002,854,338</b>	<b>100.0</b>	<b>0.9</b>	<b>11.0</b>	<b>4.2</b>	<b>7.9</b>	<b>6.0</b>	<b>7.7</b>	<b>7.4</b>	<b>Oct-95</b>
<b>Total Retirement System (Net of Fees)</b>			<b>0.9</b>	<b>10.9</b>	<b>4.0</b>	<b>7.8</b>	<b>5.9</b>	<b>7.5</b>	<b>7.2</b>	
<i>Custom Benchmark - Target Allocation</i>			<i>0.4</i>	<i>11.0</i>	<i>4.3</i>	<i>7.5</i>	<i>6.1</i>	<i>7.9</i>	<i>--</i>	<i>Oct-95</i>
<i>60% MSCI ACWI / 40% Barclays Global Aggregate</i>			<i>0.3</i>	<i>12.4</i>	<i>4.2</i>	<i>6.6</i>	<i>4.9</i>	<i>6.1</i>	<i>6.1</i>	<i>Oct-95</i>
<b>Domestic Equity Assets</b>	<b>130,807,630</b>	<b>13.0</b>	<b>1.3</b>	<b>19.9</b>	<b>2.6</b>	<b>12.6</b>	<b>10.4</b>	<b>13.1</b>	<b>6.4</b>	<b>Aug-00</b>
<i>Russell 3000</i>			<i>1.2</i>	<i>20.1</i>	<i>2.9</i>	<i>12.8</i>	<i>10.4</i>	<i>13.1</i>	<i>6.2</i>	<i>Aug-00</i>
<b>International Developed Market Equity</b>	<b>80,456,137</b>	<b>8.0</b>	<b>-1.1</b>	<b>12.7</b>	<b>-3.0</b>	<b>6.8</b>	<b>4.2</b>	<b>6.0</b>	<b>5.0</b>	<b>Aug-00</b>
<i>MSCI EAFE</i>			<i>-1.1</i>	<i>12.8</i>	<i>-1.3</i>	<i>6.5</i>	<i>3.3</i>	<i>4.9</i>	<i>3.5</i>	<i>Aug-00</i>
<b>International Emerging Market Equity</b>	<b>86,013,666</b>	<b>8.6</b>	<b>-3.6</b>	<b>8.6</b>	<b>-0.6</b>	<b>7.2</b>	<b>2.9</b>	<b>5.0</b>	<b>6.4</b>	<b>Aug-06</b>
<i>MSCI Emerging Markets</i>			<i>-4.2</i>	<i>5.9</i>	<i>-2.0</i>	<i>6.0</i>	<i>2.3</i>	<i>3.4</i>	<i>4.6</i>	<i>Aug-06</i>
<b>Core Fixed Income</b>	<b>104,390,127</b>	<b>10.4</b>	<b>1.8</b>	<b>7.9</b>	<b>8.9</b>	<b>2.8</b>	<b>2.9</b>	<b>3.7</b>	<b>4.4</b>	<b>May-05</b>
<i>Custom Benchmark - Fixed Income</i>			<i>1.8</i>	<i>7.7</i>	<i>8.9</i>	<i>2.6</i>	<i>3.0</i>	<i>3.4</i>	<i>4.0</i>	<i>May-05</i>
<b>Value Added Fixed Income</b>	<b>63,570,653</b>	<b>6.3</b>	<b>0.2</b>	<b>9.5</b>	<b>8.1</b>	<b>5.1</b>	<b>4.4</b>	<b>6.0</b>	<b>7.1</b>	<b>May-05</b>
<i>Custom High Yield Benchmark</i>			<i>0.9</i>	<i>9.4</i>	<i>6.8</i>	<i>4.9</i>	<i>4.3</i>	<i>--</i>	<i>--</i>	<i>May-05</i>
<b>Real Estate</b>	<b>73,353,658</b>	<b>7.3</b>	<b>2.7</b>	<b>8.3</b>	<b>7.7</b>	<b>8.0</b>	<b>9.8</b>	<b>10.2</b>	<b>7.8</b>	<b>Oct-00</b>
<i>NCREIF ODCE</i>			<i>1.3</i>	<i>3.8</i>	<i>5.6</i>	<i>7.3</i>	<i>9.3</i>	<i>10.9</i>	<i>8.0</i>	<i>Oct-00</i>
<b>Private Equity</b>	<b>78,305,433</b>	<b>7.8</b>	<b>5.4</b>	<b>10.5</b>	<b>13.2</b>	<b>14.0</b>	<b>9.2</b>	<b>10.0</b>	<b>9.6</b>	<b>Oct-00</b>
<i>Cambridge Associates Fund of Funds Composite 1-Quarter Lag</i>			<i>4.1</i>	<i>7.1</i>	<i>11.1</i>	<i>13.3</i>	<i>10.8</i>	<i>12.5</i>	<i>6.8</i>	<i>Oct-00</i>
<b>PRIT General Allocation</b>	<b>306,011,838</b>	<b>30.5</b>	<b>1.3</b>	<b>11.2</b>	<b>4.2</b>	<b>8.3</b>	<b>--</b>	<b>--</b>	<b>9.0</b>	<b>Jun-16</b>
<i>60% MSCI ACWI / 40% Barclays Global Aggregate</i>			<i>0.3</i>	<i>12.4</i>	<i>4.2</i>	<i>6.6</i>	<i>4.9</i>	<i>6.1</i>	<i>7.2</i>	<i>Jun-16</i>
<b>Real Assets</b>	<b>78,505,873</b>	<b>7.8</b>	<b>-0.3</b>	<b>3.3</b>	<b>3.6</b>	<b>7.8</b>	<b>5.2</b>	<b>4.4</b>	<b>4.0</b>	<b>Oct-06</b>
<i>CPI + 3%</i>			<i>1.1</i>	<i>3.7</i>	<i>4.7</i>	<i>5.1</i>	<i>4.5</i>	<i>4.7</i>	<i>4.8</i>	<i>Oct-06</i>
<b>Cash</b>	<b>1,439,325</b>	<b>0.1</b>								

Custom Benchmark - Fixed Income is comprised of 70% Barclays US Aggregate Index and 30% Barclays 1-10 Year TIPS Index.

Custom High Yield Benchmark is comprised of one third Barclays High Yield Index, one third Credit Suisse Leveraged Loans Index, and the final third being split evenly between JPMorgan's Emerging Market Bond Index and Emerging Markets Government Bond Index.



## Retirement System Summary

As of September 30, 2019

## Trailing Performance

	Market Value (\$)	% of Portfolio	% of Sector	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
<b>Total Retirement System</b>	<b>1,002,854,338</b>	<b>100.0</b>	<b>--</b>	<b>0.9</b>	<b>11.0</b>	<b>4.2</b>	<b>7.9</b>	<b>6.0</b>	<b>7.7</b>	<b>7.4</b>	<b>Oct-95</b>
<b>Total Retirement System (Net of Fees)</b>				<b>0.9</b>	<b>10.9</b>	<b>4.0</b>	<b>7.8</b>	<b>5.9</b>	<b>7.5</b>	<b>7.2</b>	
Custom Benchmark - Target Allocation				0.4	11.0	4.3	7.5	6.1	7.9	--	Oct-95
60% MSCI ACWI / 40% Barclays Global Aggregate				0.3	12.4	4.2	6.6	4.9	6.1	6.1	Oct-95
<b>Domestic Equity Assets</b>	<b>130,807,630</b>	<b>13.0</b>	<b>13.0</b>	<b>1.3</b>	<b>19.9</b>	<b>2.6</b>	<b>12.6</b>	<b>10.4</b>	<b>13.1</b>	<b>6.4</b>	<b>Aug-00</b>
Russell 3000				1.2	20.1	2.9	12.8	10.4	13.1	6.2	Aug-00
SSgA S&P 500 Index (Net of Fees)	39,323,500	3.9	30.1	1.7	20.5	4.2	13.4	10.9	13.3	6.8	Aug-98
S&P 500				1.7	20.6	4.3	13.4	10.8	13.2	6.7	Aug-98
Large Cap MStar MF Median				1.2	19.5	2.9	12.4	9.5	12.3	6.8	Aug-98
Large Cap MStar MF Rank				35	36	33	34	27	27	51	Aug-98
SSgA Russell 1000 Growth Index (Net of Fees)	35,305,353	3.5	27.0	1.5	23.3	3.7	16.9	13.4	--	15.2	Nov-09
Russell 1000 Growth				1.5	23.3	3.7	16.9	13.4	14.9	15.2	Nov-09
Large Growth MStar MF Median				0.1	21.3	2.6	15.2	11.7	13.7	14.0	Nov-09
Large Growth MStar MF Rank				19	27	39	26	18	--	15	Nov-09
SSgA Russell 1000 Value Index (Net of Fees)	34,660,564	3.5	26.5	1.4	17.8	4.0	9.5	7.9	11.5	7.4	Jul-05
Russell 1000 Value				1.4	17.8	4.0	9.4	7.8	11.5	7.4	Jul-05
Large Value MStar MF Median				1.6	17.2	2.5	9.8	7.5	11.0	7.4	Jul-05
Large Value MStar MF Rank				57	39	37	59	41	33	49	Jul-05
SSgA S&P Midcap 400 Index (Net of Fees)	9,517,594	0.9	7.3	-0.1	17.9	-2.5	9.4	8.9	12.6	9.2	Sep-06
S&P 400 MidCap				-0.1	17.9	-2.5	9.4	8.9	12.6	9.2	Sep-06
Mid Cap MStar MF Median				-0.2	20.7	0.6	10.2	8.5	12.0	8.5	Sep-06
Mid Cap MStar MF Rank				46	70	64	57	42	37	36	Sep-06
Lee Munder Small Cap Value (Net of Fees)	12,000,618	1.2	9.2	0.2	16.8	-5.4	6.5	8.2	--	11.1	Nov-09
Russell 2000 Value				-0.6	12.8	-8.2	6.5	7.2	10.1	10.9	Nov-09
Small Value MStar MF Median				-0.9	12.9	-8.7	5.7	5.6	9.9	10.5	Nov-09
Small Value MStar MF Rank				30	19	24	26	11	--	36	Nov-09



## Retirement System Summary

As of September 30, 2019

	Market Value (\$)	% of Portfolio	% of Sector	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
<b>International Developed Market Equity</b>	<b>80,456,137</b>	<b>8.0</b>	<b>8.0</b>	<b>-1.1</b>	<b>12.7</b>	<b>-3.0</b>	<b>6.8</b>	<b>4.2</b>	<b>6.0</b>	<b>5.0</b>	<b>Aug-00</b>
MSCI EAFE				-1.1	12.8	-1.3	6.5	3.3	4.9	3.5	Aug-00
SSgA MSCI EAFE Index	57,252,760	5.7	71.2	-1.0	13.2	-1.2	6.8	3.6	5.2	5.7	Sep-04
MSCI EAFE				-1.1	12.8	-1.3	6.5	3.3	4.9	5.4	Sep-04
Foreign MStar MF Median				-1.5	12.4	-2.8	5.7	3.3	5.4	5.9	Sep-04
Foreign MStar MF Rank				30	40	33	27	46	53	54	Sep-04
Acadian Non-U.S. Small Cap Equity (Net of Fees)	23,203,377	2.3	28.8	-1.6	10.6	-8.7	6.2	6.5	8.7	7.5	Feb-05
MSCI EAFE Small Cap				-0.4	12.1	-5.9	5.9	6.0	7.5	6.2	Feb-05
eV EAFE Small Cap Core Net Median				-1.9	10.7	-7.9	5.6	5.5	8.7	7.5	Feb-05
eV EAFE Small Cap Core Net Rank				41	52	62	45	27	50	51	Feb-05
<b>International Emerging Market Equity</b>	<b>86,013,666</b>	<b>8.6</b>	<b>8.6</b>	<b>-3.6</b>	<b>8.6</b>	<b>-0.6</b>	<b>7.2</b>	<b>2.9</b>	<b>5.0</b>	<b>6.4</b>	<b>Aug-06</b>
MSCI Emerging Markets				-4.2	5.9	-2.0	6.0	2.3	3.4	4.6	Aug-06
PRIT Emerging Markets (Net of Fees)	86,013,666	8.6	100.0	-3.6	8.6	-0.6	7.2	--	--	7.6	Sep-16
MSCI Emerging Markets				-4.2	5.9	-2.0	6.0	2.3	3.4	6.2	Sep-16
eV Emg Mkts Equity Net Median				-3.8	7.7	-0.6	5.7	2.5	4.0	5.9	Sep-16
eV Emg Mkts Equity Net Rank				45	42	51	27	--	--	26	Sep-16
<b>Core Fixed Income</b>	<b>104,390,127</b>	<b>10.4</b>	<b>10.4</b>	<b>1.8</b>	<b>7.9</b>	<b>8.9</b>	<b>2.8</b>	<b>2.9</b>	<b>3.7</b>	<b>4.4</b>	<b>May-05</b>
Custom Benchmark - Fixed Income				1.8	7.7	8.9	2.6	3.0	3.4	4.0	May-05
IR&M Aggregate Bond	67,085,921	6.7	64.3	2.4	8.9	10.6	3.2	3.6	--	3.8	Feb-14
BBgBarc US Aggregate TR				2.3	8.5	10.3	2.9	3.4	3.7	3.4	Feb-14
Intermediate Core Bond MStar MF Median				2.2	8.5	10.1	2.9	3.3	3.9	3.3	Feb-14
Intermediate Core Bond MStar MF Rank				14	31	16	26	14	--	9	Feb-14
IR&M Intermediate TIPS	37,304,205	3.7	35.7	0.6	5.9	5.8	2.0	2.0	--	1.9	Feb-14
BBgBarc US TIPS 1-10 Yr TR				0.6	5.8	5.7	1.9	2.0	2.7	1.8	Feb-14
Inflation-Protected Bond MStar MF Median				1.1	7.4	5.9	2.1	2.0	3.1	2.0	Feb-14
Inflation-Protected Bond MStar MF Rank				69	65	58	57	53	--	64	Feb-14

## Retirement System Summary

As of September 30, 2019

	Market Value (\$)	% of Portfolio	% of Sector	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
<b>Value Added Fixed Income</b>	<b>63,570,653</b>	<b>6.3</b>	<b>6.3</b>	<b>0.2</b>	<b>9.5</b>	<b>8.1</b>	<b>5.1</b>	<b>4.4</b>	<b>6.0</b>	<b>7.1</b>	<b>May-05</b>
Custom High Yield Benchmark				0.9	9.4	6.8	4.9	4.3	--	--	May-05
<b>High Yield Bonds</b>	<b>24,753,767</b>	<b>2.5</b>	<b>38.9</b>	<b>0.4</b>	<b>8.3</b>	<b>4.1</b>	<b>4.8</b>	<b>4.3</b>	<b>6.2</b>	<b>6.0</b>	<b>Jun-08</b>
50% BBgBarc US High Yield/ 50% Credit Suisse Leveraged Loans				1.1	8.9	4.7	5.4	4.8	6.7	6.5	Jun-08
Loomis Sayles High Yield (Net of Fees)	13,255,264	1.3	53.5	-0.6	9.0	3.9	4.9	--	--	--	Jan-96
BBgBarc US High Yield TR				1.3	11.4	6.4	6.1	5.4	7.9	7.1	Jan-96
eV US High Yield Fixed Inc Gross Median				1.5	11.5	6.6	6.1	5.4	7.9	7.5	Jan-96
eV US High Yield Fixed Inc Gross Rank				99	79	92	92	--	--	--	Jan-96
Loomis Sayles Bank Loans (Net of Fees)	11,498,503	1.1	46.5	1.3	6.7	3.3	3.7	--	--	--	Oct-05
Credit Suisse Leveraged Loans				0.9	6.4	3.1	4.7	4.1	5.4	4.5	Oct-05
eV US Float-Rate Bank Loan Fixed Inc Gross Median				1.2	7.0	3.5	4.6	4.3	5.6	5.0	Oct-05
eV US Float-Rate Bank Loan Fixed Inc Gross Rank				42	58	62	97	--	--	--	Oct-05
<b>Total Emerging Markets Debt</b>	<b>30,772,778</b>	<b>3.1</b>	<b>48.4</b>	<b>-0.3</b>	<b>11.1</b>	<b>10.7</b>	<b>3.2</b>	<b>1.9</b>	<b>--</b>	<b>1.5</b>	<b>Aug-13</b>
50% JPM EMBI GD / 50% JPM GBI-EM				0.4	10.4	10.9	3.9	3.2	4.7	3.2	Aug-13
Lazard Emerging Market Debt Blend	30,772,778	3.1	100.0	-0.3	11.1	10.7	3.2	1.9	--	2.1	Aug-13
50% JPM EMBI GD / 50% JPM GBI-EM				0.4	10.4	10.9	3.9	3.2	4.7	3.2	Aug-13
Emerging Markets Bond MStar MF Median				0.2	10.2	9.4	4.0	4.3	5.9	4.5	Aug-13
Emerging Markets Bond MStar MF Rank				58	38	18	76	86	--	81	Aug-13
<b>Mezzanine Debt</b>	<b>8,044,108</b>	<b>0.8</b>	<b>12.7</b>	<b>1.9</b>	<b>7.7</b>	<b>10.8</b>	<b>12.3</b>	<b>12.8</b>	<b>10.2</b>	<b>--</b>	<b>Oct-02</b>
Northstar Mezzanine Partners VI	5,365,617	0.5	66.7								
Newstone Capital Partners II	689,111	0.1	8.6								
Northstar Mezzanine Partners V	1,767,175	0.2	22.0								
Northstar Mezzanine Partners IV	143,213	0.0	1.8								
Newstone Capital Partners	0	0.0	0.0								
Northstar Mezzanine Partners III	78,992	0.0	1.0								

## Retirement System Summary

As of September 30, 2019

	Market Value (\$)	% of Portfolio	% of Sector	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
<b>Real Estate</b>	<b>73,353,658</b>	<b>7.3</b>	<b>7.3</b>	<b>2.7</b>	<b>8.3</b>	<b>7.7</b>	<b>8.0</b>	<b>9.8</b>	<b>10.2</b>	<b>7.8</b>	<b>Oct-00</b>
<i>NCREIF ODCE</i>				1.3	3.8	5.6	7.3	9.3	10.9	8.0	Oct-00
<b>Open-End Real Estate</b>	<b>69,454,107</b>	<b>6.9</b>	<b>94.7</b>	<b>2.5</b>	<b>7.9</b>	<b>6.6</b>	<b>7.4</b>	<b>9.3</b>	<b>9.9</b>	<b>7.3</b>	<b>Jan-99</b>
PRIT Real Estate	69,454,107	6.9	100.0	2.5	7.9	6.6	7.0	9.4	--	11.0	Apr-10
<i>NCREIF ODCE</i>				1.3	3.8	5.6	7.3	9.3	10.9	11.8	Apr-10
<i>NCREIF ODCE Equal Weighted</i>				1.4	4.5	6.2	7.6	9.6	10.8	11.9	Apr-10
<i>Custom Benchmark</i>				2.0	7.0	7.3	7.3	9.3	10.9	11.6	Apr-10
<b>Non-Core Real Estate</b>	<b>3,899,551</b>	<b>0.4</b>	<b>5.3</b>	<b>5.2</b>	<b>14.2</b>	<b>19.8</b>	<b>15.2</b>	<b>15.7</b>	<b>14.7</b>	<b>12.9</b>	<b>Oct-05</b>
AEW Partners VII	3,899,551	0.4	100.0								
AEW Partners VI	0	0.0	0.0								

## Retirement System Summary

As of September 30, 2019

	Market Value (\$)	% of Portfolio	% of Sector	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
<b>Private Equity</b>	<b>78,305,433</b>	<b>7.8</b>	<b>7.8</b>	<b>5.4</b>	<b>10.5</b>	<b>13.2</b>	<b>14.0</b>	<b>9.2</b>	<b>10.0</b>	<b>9.6</b>	<b>Oct-00</b>
<i>Cambridge Associates Fund of Funds Composite 1-Quarter Lag</i>				<i>4.1</i>	<i>7.1</i>	<i>11.1</i>	<i>13.3</i>	<i>10.8</i>	<i>12.5</i>	<i>6.8</i>	<i>Oct-00</i>
<b>Buyouts</b>	<b>46,784,971</b>	<b>4.7</b>	<b>59.7</b>	<b>8.0</b>	<b>13.7</b>	<b>17.8</b>	<b>18.3</b>	<b>12.4</b>	<b>11.4</b>	<b>12.8</b>	<b>Oct-05</b>
American Securities Partners VI	3,686,350	0.4	7.9								
Riverside Capital Appreciation Fund VI	5,511,033	0.5	11.8								
Vitruvian Investment Partnership I	1,467,759	0.1	3.1								
Riverside Micro Cap Fund III	9,416,166	0.9	20.1								
Ridgemont II	10,258,824	1.0	21.9								
Capital International Private Equity Fund VI	6,411,290	0.6	13.7								
Harvest Partners V	736,500	0.1	1.6								
TA XII	8,208,784	0.8	17.5								
Riverside Capital Fund V	668,749	0.1	1.4								
Riverside Europe III	201,648	0.0	0.4								
Charlesbank Equity Fund VI	217,868	0.0	0.5								
<b>Fund of Funds</b>	<b>21,716,496</b>	<b>2.2</b>	<b>27.7</b>	<b>2.5</b>	<b>12.1</b>	<b>12.2</b>	<b>2.7</b>	<b>-4.8</b>	<b>2.0</b>	<b>7.1</b>	<b>Oct-05</b>
PRIT Vintage Year 2016	5,194,158	0.5	23.9								
PRIT Vintage Year 2017	9,819,561	1.0	45.2								
European Strategic Partners	73,604	0.0	0.3								
INVESCO Private Capital II	40,740	0.0	0.2								
PRIT Vintage Year 2018	5,160,430	0.5	23.8								
PRIT Vintage Year 2019	1,428,004	0.1	6.6								

## Retirement System Summary

As of September 30, 2019

	Market Value (\$)	% of Portfolio	% of Sector	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
<b>Venture Capital Funds</b>	<b>9,803,966</b>	<b>1.0</b>	<b>12.5</b>	<b>-0.7</b>	<b>-5.6</b>	<b>-5.5</b>	<b>-0.2</b>	<b>-0.3</b>	<b>5.2</b>	<b>5.7</b>	<b>Oct-05</b>
Ascent Venture Partners V	4,274,284	0.4	43.6								
Ascent Venture Partners VI	4,335,993	0.4	44.2								
Boston Millennia Partners III	483,341	0.0	4.9								
Boston Millennia Partners II	449,367	0.0	4.6								
Ascent Venture Partners II	22,681	0.0	0.2								
Ascent Venture Partners IV	47,988	0.0	0.5								
Ascent Venture Partners III	190,312	0.0	1.9								
<b>PRIT General Allocation</b>	<b>306,011,838</b>	<b>30.5</b>	<b>30.5</b>	<b>1.3</b>	<b>11.2</b>	<b>4.2</b>	<b>8.3</b>	<b>--</b>	<b>--</b>	<b>9.0</b>	<b>Jun-16</b>
60% MSCI ACWI / 40% Barclays Global Aggregate				0.3	12.4	4.2	6.6	4.9	6.1	7.2	Jun-16
PRIT General Allocation Fund (Net of Fees)	306,011,838	30.5	100.0	1.3	11.2	4.2	8.3	--	--	9.0	Jun-16
60% MSCI ACWI / 40% Barclays Global Aggregate				0.3	12.4	4.2	6.6	4.9	6.1	7.2	Jun-16

## Retirement System Summary

As of September 30, 2019

	Market Value (\$)	% of Portfolio	% of Sector	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
<b>Real Assets</b>	<b>78,505,873</b>	<b>7.8</b>	<b>7.8</b>	<b>-0.3</b>	<b>3.3</b>	<b>3.6</b>	<b>7.8</b>	<b>5.2</b>	<b>4.4</b>	<b>4.0</b>	<b>Oct-06</b>
<i>CPI + 3%</i>				1.1	3.7	4.7	5.1	4.5	4.7	4.8	Oct-06
<b>Natural Resources Assets</b>	<b>14,748,363</b>	<b>1.5</b>	<b>18.8</b>	<b>-6.9</b>	<b>-5.4</b>	<b>-13.9</b>	<b>4.6</b>	<b>-2.0</b>	<b>--</b>	<b>--</b>	
<i>S&amp;P Global Natural Resources Index TR USD</i>				-6.0	7.0	-11.0	7.0	1.1	1.7	--	
<b>Natural Resources (Public)</b>	<b>8,228,171</b>	<b>0.8</b>	<b>55.8</b>	<b>-5.9</b>	<b>7.5</b>	<b>-6.0</b>	<b>6.8</b>	<b>0.1</b>	<b>--</b>	<b>-2.4</b>	<b>May-11</b>
SSgA Global Natural Resources Stock Index (Net of Fees)	8,228,171	0.8	100.0	-6.0	7.4	-6.2	6.7	--	--	--	May-11
<i>S&amp;P Global LargeMidCap Commodity and Resources NR USD</i>				-6.0	7.3	-6.3	6.3	-0.3	1.6	-2.6	May-11
<i>Natural Resources MStar MF Median</i>				-5.4	7.1	-15.3	1.3	-3.3	0.9	-3.1	May-11
<i>Natural Resources MStar MF Rank</i>				56	37	15	8	--	--	--	May-11
<b>Natural Resources (Private)</b>	<b>6,520,192</b>	<b>0.7</b>	<b>44.2</b>	<b>-8.0</b>	<b>-17.9</b>	<b>-22.2</b>	<b>2.2</b>	<b>-8.1</b>	<b>--</b>	<b>4.9</b>	<b>Jul-10</b>
White Deer Energy II	6,166,742	0.6	94.6								
White Deer Energy	353,450	0.0	5.4								
<b>Timber</b>	<b>8,712,715</b>	<b>0.9</b>	<b>11.1</b>	<b>-2.7</b>	<b>-11.3</b>	<b>-12.5</b>	<b>-6.2</b>	<b>-3.4</b>	<b>-1.3</b>	<b>0.5</b>	<b>Oct-05</b>
<i>NCREIF Timberland (1-Quarter Lag)</i>				1.0	1.9	2.9	3.3	4.6	4.0	6.6	Oct-05
RMK Select Timberland Investment Fund I	4,394,734	0.4	50.4								
Hancock Timberland VII	1,523,353	0.2	17.5								
RMK Select Timberland Investment Fund II	2,794,628	0.3	32.1								
RMK Balanced Timberland B	0	0.0	0.0								

## Retirement System Summary

As of September 30, 2019

	Market Value (\$)	% of Portfolio	% of Sector	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
<b>Infrastructure</b>	<b>55,044,796</b>	<b>5.5</b>	<b>70.1</b>	<b>2.0</b>	<b>8.8</b>	<b>13.5</b>	<b>15.8</b>	<b>26.0</b>	<b>20.7</b>	<b>16.0</b>	<b>Jun-08</b>
<i>CPI+5%</i>				1.6	5.1	6.7	7.1	6.5	6.7	6.6	Jun-08
IFM Global Infrastructure (Net of Fees)	41,381,716	4.1	75.2	2.2	8.9	12.1	--	--	--	15.7	Sep-17
Global Infrastructure Partners	959,583	0.1	1.7								
Global Infrastructure Partners III	12,564,400	1.3	22.8								
Global Infrastructure Partners IV, L.P.	139,096	0.0	0.3								
<b>Cash</b>	<b>1,439,325</b>	<b>0.1</b>	<b>0.1</b>								
Cash	1,439,325	0.1	100.0								

## Retirement System Detail

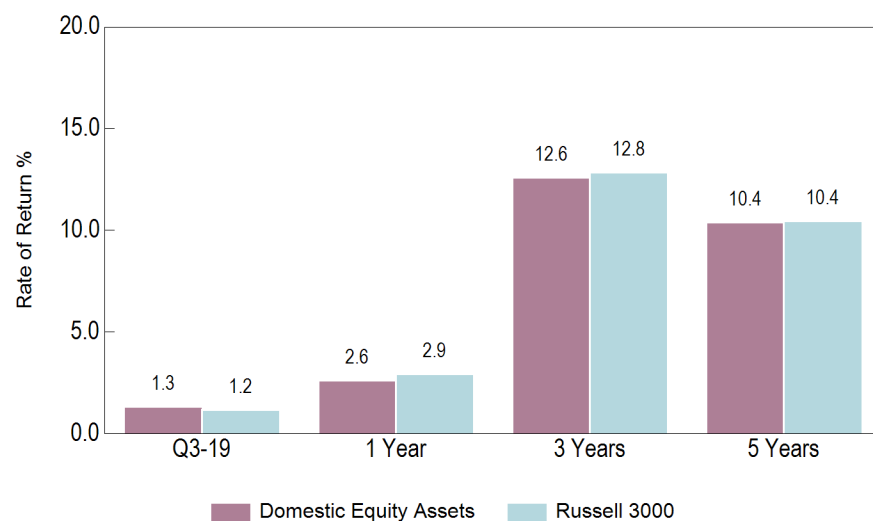
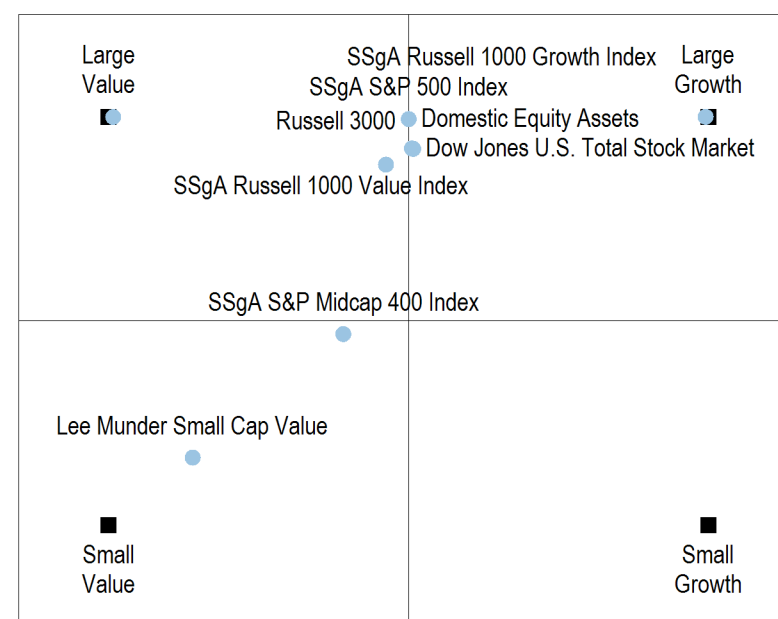


## Domestic Equity Assets

As of September 30, 2019

## Asset Allocation on September 30, 2019

	Actual	Actual
SSgA S&P 500 Index	\$39,323,500	30.1%
SSgA Russell 1000 Growth Index	\$35,305,353	27.0%
SSgA Russell 1000 Value Index	\$34,660,564	26.5%
SSgA S&P Midcap 400 Index	\$9,517,594	7.3%
Lee Munder Small Cap Value	\$12,000,618	9.2%
<b>Total</b>	<b>\$130,807,630</b>	<b>100.0%</b>

Return Summary  
Ending September 30, 2019Domestic Equity Assets Style Map  
3 Years Ending September 30, 2019

As of September 30, 2019

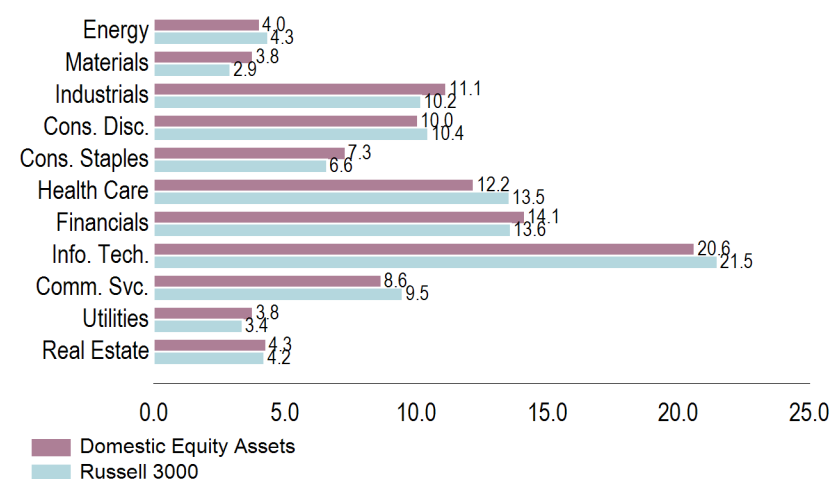
## Domestic Equity Equity Characteristics

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
<b>Market Value</b>			
Market Value (\$M)	130.81	--	129.17
Number Of Holdings	1215	2988	1205
<b>Characteristics</b>			
Weighted Avg. Market Cap. (\$B)	183.74	195.28	178.74
Median Market Cap (\$B)	9.23	1.58	9.29
P/E Ratio	20.37	20.51	20.29
Yield	1.90	1.88	1.88
EPS Growth - 5 Yrs.	12.41	13.53	12.26
Price to Book	3.30	3.48	3.25
Beta (holdings; domestic)	1.02	1.02	1.04

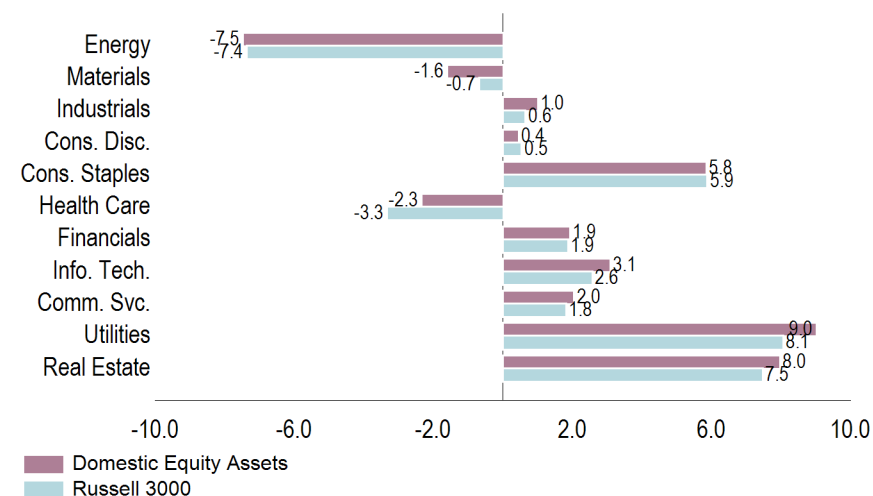
## Top Holdings

MICROSOFT	3.3%
APPLE	3.1%
AMAZON.COM	2.3%
FACEBOOK CLASS A	1.3%
BERKSHIRE HATHAWAY 'B'	1.3%
JP MORGAN CHASE & CO.	1.2%
ALPHABET 'C'	1.2%
ALPHABET A	1.2%
JOHNSON & JOHNSON	1.1%
PROCTER & GAMBLE	1.0%
<b>Total</b>	<b>17.0%</b>

## Sector Allocation (%) vs Russell 3000



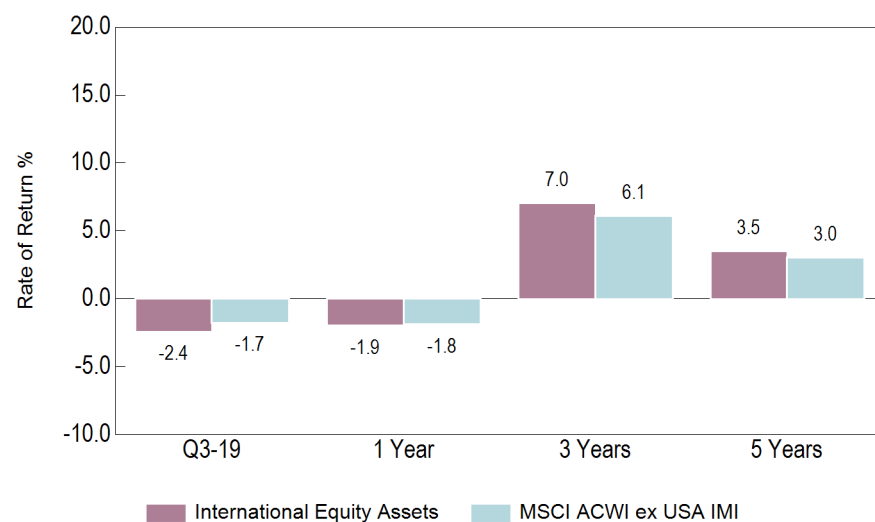
## Sector Returns (%) vs Russell 3000



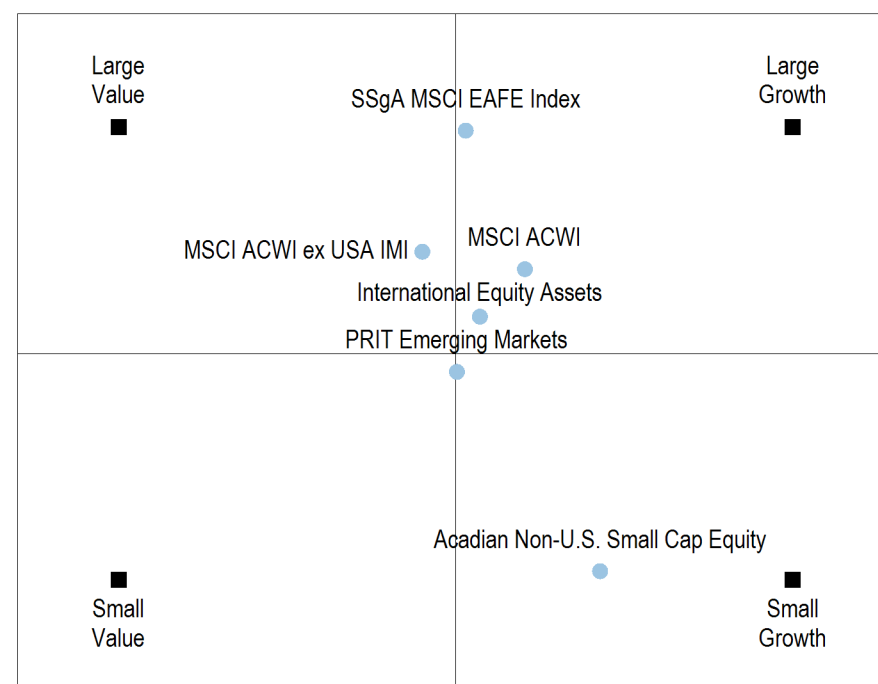
### Asset Allocation on September 30, 2019

	Actual	Actual
SSgA MSCI EAFE Index	\$57,252,760	34.4%
Acadian Non-U.S. Small Cap Equity	\$23,203,377	13.9%
PRIT Emerging Markets	\$86,013,666	51.7%
<b>Total</b>	<b>\$166,469,803</b>	<b>100.0%</b>

### Return Summary Ending September 30, 2019



### International Equity Assets Style Map 3 Years Ending September 30, 2019



Worcester Retirement System  
International Equity Assets

As of September 30, 2019

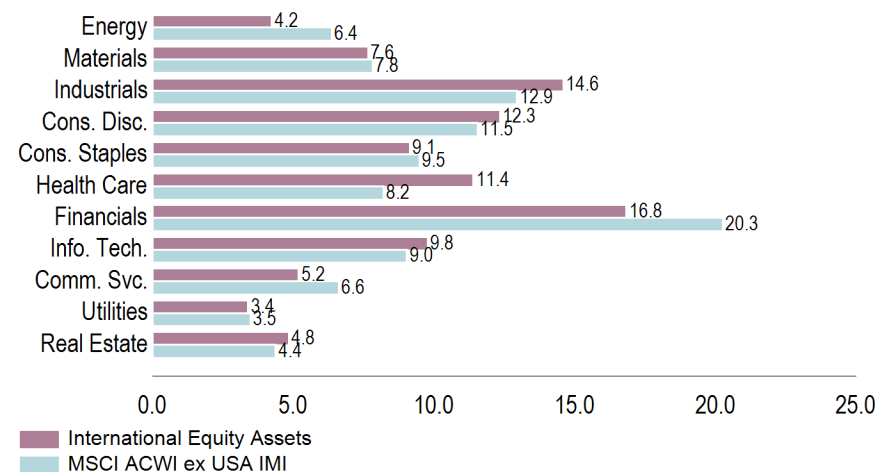
International Equity Characteristics

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
<b>Market Value</b>			
Market Value (\$M)	166.47	--	176.64
Number Of Holdings	2353	6374	2360
<b>Characteristics</b>			
Weighted Avg. Market Cap. (\$B)	43.05	55.86	44.92
Median Market Cap (\$B)	1.69	1.52	1.62
P/E Ratio	14.82	14.95	14.53
Yield	3.17	3.21	3.18
EPS Growth - 5 Yrs.	9.11	9.16	9.85
Price to Book	2.23	2.28	2.25
Beta (holdings; domestic)	0.98	1.03	1.00

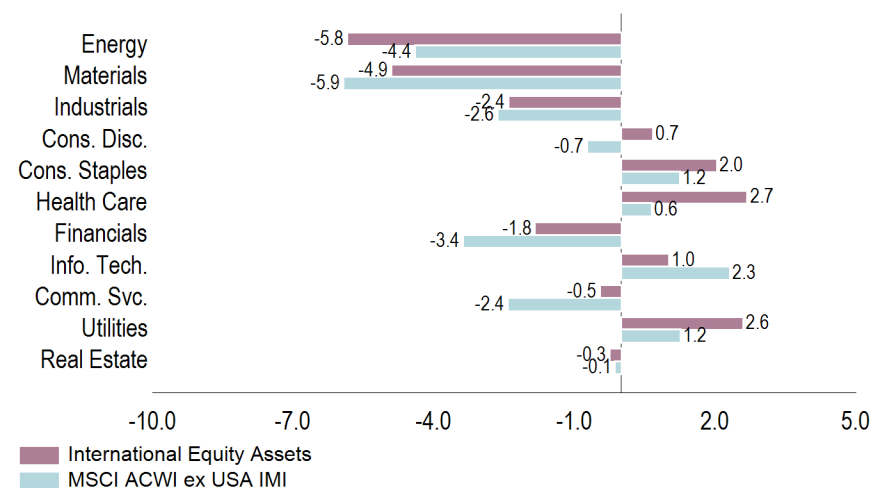
Top Holdings

NESTLE 'R'	1.7%
ROCHE HOLDING	1.0%
NOVARTIS 'R'	0.9%
HSBC HOLDINGS	0.8%
TOYOTA MOTOR	0.8%
DISCOUNT	0.7%
BP	0.7%
ROYAL DUTCH SHELL A(LON)	0.6%
TOTAL	0.6%
ASTRAZENECA	0.6%
<b>Total</b>	<b>8.4%</b>

Sector Allocation (%) vs MSCI ACWI ex USA IMI



Sector Returns (%) vs MSCI ACWI ex USA IMI



As of September 30, 2019

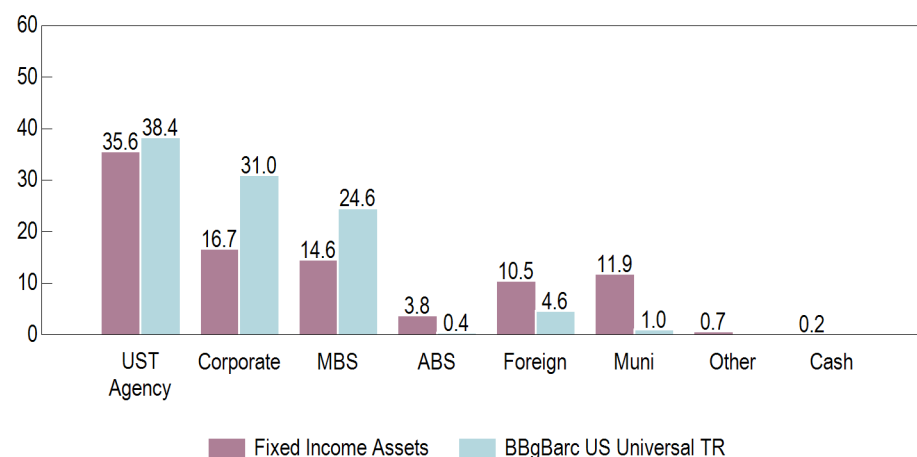
## Asset Allocation on September 30, 2019

	Actual	Actual
IR&M Aggregate Bond	\$67,085,921	39.9%
IR&M Intermediate TIPS	\$37,304,205	22.2%
Lazard Emerging Market Debt Blend	\$30,772,778	18.3%
Loomis Sayles Bank Loans	\$11,498,503	6.8%
Loomis Sayles High Yield	\$13,255,264	7.9%
Newstone Capital Partners II	\$689,111	0.4%
Northstar Mezzanine Partners III	\$78,992	0.0%
Northstar Mezzanine Partners IV	\$143,213	0.1%
Northstar Mezzanine Partners V	\$1,767,175	1.1%
Northstar Mezzanine Partners VI	\$5,365,617	3.2%
<b>Total</b>	<b>\$167,960,780</b>	<b>100.0%</b>

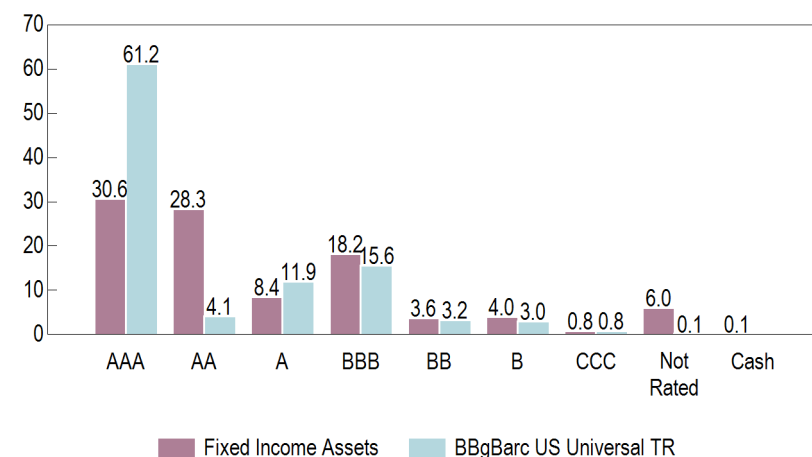
Fixed Income Characteristics  
vs. BBgBarc US Universal TR

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
Fixed Income Characteristics			
Yield to Maturity	2.66	2.68	3.15
Average Duration	5.78	6.13	5.64
Average Quality	AA	AA	AA
Weighted Average Maturity	7.89	12.18	7.83

## Sector Allocation



## Credit Quality Allocation



As of September 30, 2019

Partnership	Vintage Year	Committed(\$)	Called	Distributed	Fair Value	Net IRR	Net Multiple
Ascent Venture Partners II	1995	\$2.0	\$1.9	\$6.4	<\$0.1	27.3%	3.3x
						BUY: 9.7%, VC:-2.2%,	
INVESCO Private Capital Fund of Funds	1998	\$5.0	\$4.6	\$6.6	\$0.1	Non-US 10.0%	1.4x
Ascent Venture Partners III	1999	\$5.0	\$4.7	\$5.7	\$0.2	3.8%	1.3x
European Strategic Partners	2000	€ 6.0	\$6.9	\$10.9	<\$0.1	11.4%	1.6x
Boston Millennia Partners II	2000	\$4.0	\$4.0	\$3.0	\$0.5	-1.5%	0.9x
Ascent Venture Partners IV	2003	\$3.0	\$3.0	\$0.5	<\$0.1	-31.4%	0.2x
Charlesbank Equity Fund VI	2005	\$3.0	\$2.9	\$3.8	\$0.3	9.9%	1.4x
Riverside Europe III	2006	€ 5.0	\$6.3	\$5.1	\$0.2	-1.1%	0.8x
Harvest Partners V	2007	\$6.0	\$5.5	\$9.3	\$1.0	18.6%	1.9x
Riverside Capital Fund V	2007	\$4.0	\$3.8	\$4.4	\$0.7	8.7%	1.3x
Vitruvian Investment Partnership I	2007	€ 4.0	\$4.4	\$6.4	\$4.3	11.2%	2.4x
Boston Millennia Partners III	2010	\$3.0	\$2.0	\$2.8	\$0.5	16.6%	1.7x
Capital International Private Equity Fund VI	2010	\$7.5	\$6.3	\$2.0	\$6.6	-4.6%	1.4x
Ascent Venture Partners V	2010	\$5.0	\$4.7	\$3.3	\$4.3	8.4%	1.6x
American Securities Partners VI	2011	\$7.5	\$6.3	\$9.7	\$3.3	21.8%	2.1x
Riverside Capital Appreciation Fund VI	2013	\$7.5	\$7.0	\$3.7	\$6.5	13.9%	1.5x
Riverside Micro Cap Fund III	2014	\$7.5	\$4.5	\$2.9	\$7.4	25.8%	2.3x
Ridgemont II	2015	\$10.0	\$6.7	\$1.2	\$9.1	21.9%	1.4x
Ascent Venture Partners VI	2015	\$5.0	\$3.7	\$0.0	\$4.4	8.7%	1.2x
TA XII	2015	\$6.7	\$4.2	\$0.7	\$6.7	27.9%	1.8x
PRIT VY 2016	2016	\$8.3	\$5.3	\$0.0	\$5.4	NM	1.0x
PRIT VY 2017	2017	\$31.2	\$8.2	\$0.1	\$8.3	NM	1.0x
PRIT VY 2018	2018	\$14.1	\$4.6	\$0.0	\$4.1	NM	0.9x
<b>Total Program (USD \$)</b>		<b>\$145.3</b>	<b>\$111.6</b>	<b>\$88.5</b>	<b>\$73.9</b>		<b>1.5x</b>
<b>Total Program (EUR €)</b>		<b>€ 15.0</b>					

Fair values for private markets assets are based on reported values of 3/31/19, adjusted for cash flows through 6/30/19.

Unless otherwise denoted, all values have been converted into US dollars using 3/31/2019 exchange rates.

Ascent Venture Partners II is winding down as of 8/31/2017, left over value is tax held back.

European Strategic Partners is winding down as of 3/31/2018 and only provides data annually.

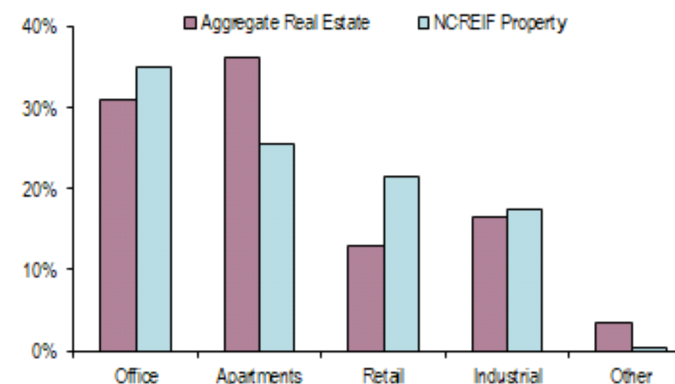
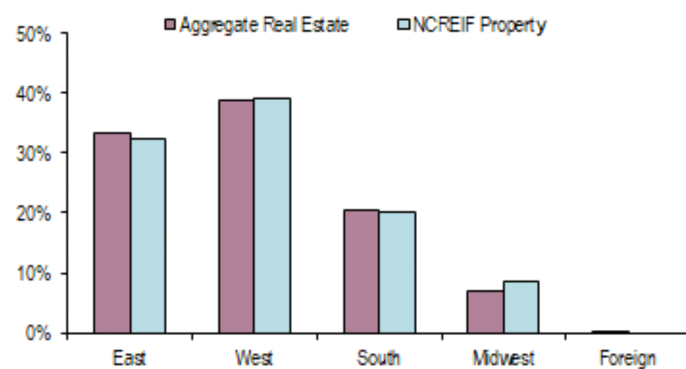
## Mezzanine Debt Assets

As of September 30, 2019

Partnership	Vintage Year	Committed(\$)	Called	Distributed	Fair Value	Net IRR	Net Multiple
Newstone Capital	2006	\$5.0	\$5.9	\$7.9	\$<0.1	7.9%	1.3x
Newstone II	2010	\$5.0	\$6.6	\$7.4	\$0.7	8.5%	1.2x
Northstar Mezzanine Partners III	2002	\$5.0	\$5.0	\$7.8	\$0.7	10.7%	1.7x
Northstar Mezzanine Partners IV	2005	\$5.0	\$5.3	\$7.9	\$0.2	9.9%	1.5x
Northstar Mezzanine Partners V	2007	\$5.0	\$5.8	\$5.9	\$1.7	7.2%	1.3x
Northstar Mezzanine Partners VI	2014	\$7.5	\$7.2	\$3.7	\$5.5	9.1%	1.3x
<b>Total Program</b>		<b>\$32.5</b>	<b>\$35.8</b>	<b>\$40.5</b>	<b>\$8.9</b>		<b>1.4x</b>

As of September 30, 2019

Partnership	Market	Strategy	Vehicle	Fair Value	Net IRR
PRIT Real Estate	Private/Public	Diversified Core	Open-end	\$67.7	NA
AEW VII	Private	Opportunistic	Close-End	\$4.8	13.2%
AEW VI	Private	Opportunistic	Close-End	\$2.2	15.7%
<b>Total Program</b>				<b>\$74.7</b>	



Regional and property type allocation as of 9/30/2019.



## Real Estate Assets

As of September 30, 2019

Partnership	Vintage Year	Committed(\$)	Called	Distributed	Fair Value	Net IRR
RMK Fund B	1999	\$5.0	\$5.0	\$8.3	\$1.2	6.7%
RMK Fund 1	2001	\$5.0	\$5.0	\$1.4	\$4.4	2.4%
White Deer	2010	\$5.0	\$5.4	\$7.0	\$0.4	22.5%
Hancock VII	2005	\$5.0	\$5.0	\$3.6	\$1.5	1.2%
RMK Fund II	2007	\$5.0	\$5.0	\$1.8	\$2.8	0.1%
Global Infrastructure Partners B	2008	\$8.0	\$7.1	\$17.8	\$1.8	13.8%
White Deer II	2013	\$10.0	\$7.9	\$0.8	\$6.7	0.8%
Global Infrastructure Partners III	2016	\$15.0	\$11.0	\$0.7	\$12.2	7.8%
IFM	2017	\$20.0	\$35.0	\$2.0	\$40.5	12%
<b>Total Program</b>		<b>\$78.0</b>	<b>\$86.4</b>	<b>\$43.5</b>	<b>\$71.5</b>	

## Portfolio Reviews

## SSgA S&amp;P 500 Index

As of September 30, 2019

## Account Information

Account Name	SSgA S&P 500 Index
Account Structure	Commingled Fund
Investment Style	Passive
Inception Date	8/01/98
Account Type	US Equity
Benchmark	S&P 500
Universe	Large Cap MStar MF

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
SSgA S&P 500 Index	1.7	20.5	4.2	13.4	10.9	13.3	6.8	Aug-98
S&P 500	1.7	20.6	4.3	13.4	10.8	13.2	6.7	Aug-98
Large Cap MStar MF Median	1.2	19.5	2.9	12.4	9.5	12.3	6.8	Aug-98
Large Cap MStar MF Rank	35	36	33	34	27	27	51	Aug-98

U.S. Effective Style Map  
3 Years Ending September 30, 2019

Large Value ■	SSgA S&P 500 Index S&P 500 ●	Large Growth ■
Small Value ■		Small Growth ■

## SSgA S&amp;P 500 Index Characteristics

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
<b>Market Value</b>			
Market Value (\$M)	39.3	--	38.7
Number Of Holdings	505	505	507
<b>Sector Distribution</b>			
Energy	4.5	4.6	5.0
Materials	2.7	2.7	2.8
Industrials	9.3	9.4	9.4
Consumer Discretionary	10.1	10.1	10.2
Consumer Staples	7.6	7.4	7.3
Health Care	13.7	13.6	14.2
Financials	13.0	13.1	13.1
Information Technology	22.0	21.9	21.5
Communication Services	10.3	10.5	10.1
Utilities	3.6	3.4	3.3
Real Estate	3.2	3.2	3.0
<b>Company Size Distribution</b>			
Weighted Avg. Market Cap. (\$B)	231.6	230.5	226.4
Median Market Cap. (\$B)	22.5	22.5	22.1
Large Cap. (%)	51.7	51.7	50.6
Medium/Large Cap. (%)	31.5	31.4	32.2
Medium Cap. (%)	15.1	15.1	15.6
Medium/Small Cap. (%)	1.6	1.5	1.6
Small Cap. (%)	0.0	0.2	0.0

## SSgA Russell 1000 Growth Index

As of September 30, 2019

## Account Information

Account Name	SSgA Russell 1000 Growth Index
Account Structure	Commingled Fund
Investment Style	Passive
Inception Date	11/01/09
Account Type	US Equity
Benchmark	Russell 1000 Growth
Universe	Large Growth MStar MF

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
SSgA Russell 1000 Growth Index	1.5	23.3	3.7	16.9	13.4	--	15.2	Nov-09
Russell 1000 Growth	1.5	23.3	3.7	16.9	13.4	14.9	15.2	Nov-09
Large Growth MStar MF Median	0.1	21.3	2.6	15.2	11.7	13.7	14.0	Nov-09
Large Growth MStar MF Rank	19	27	39	26	18	--	15	Nov-09

U.S. Effective Style Map  
3 Years Ending September 30, 2019

Large Value	SSgA Russell 1000 Growth Index Growth	Large Growth
Small Value	Russell 1000 Growth	Small Growth

## SSgA Russell 1000 Growth Index Characteristics

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
Market Value			
Market Value (\$M)	35.3	--	34.8
Number Of Holdings	529	526	546
Sector Distribution			
Energy	0.3	0.3	0.7
Materials	1.4	1.4	1.9
Industrials	10.0	9.9	11.6
Consumer Discretionary	14.4	14.6	15.1
Consumer Staples	4.9	4.8	5.7
Health Care	14.2	14.2	12.7
Financials	3.2	3.2	4.4
Information Technology	37.8	37.4	33.8
Communication Services	11.2	11.6	11.8
Utilities	0.0	0.0	0.0
Real Estate	2.6	2.5	2.4
Company Size Distribution			
Weighted Avg. Market Cap. (\$B)	303.8	300.6	285.6
Median Market Cap. (\$B)	12.2	12.2	12.3
Large Cap. (%)	55.4	55.6	50.0
Medium/Large Cap. (%)	26.2	25.5	30.4
Medium Cap. (%)	12.9	13.3	14.0
Medium/Small Cap. (%)	5.4	5.4	5.3
Small Cap. (%)	0.1	0.3	0.3

## SSgA Russell 1000 Value Index

As of September 30, 2019

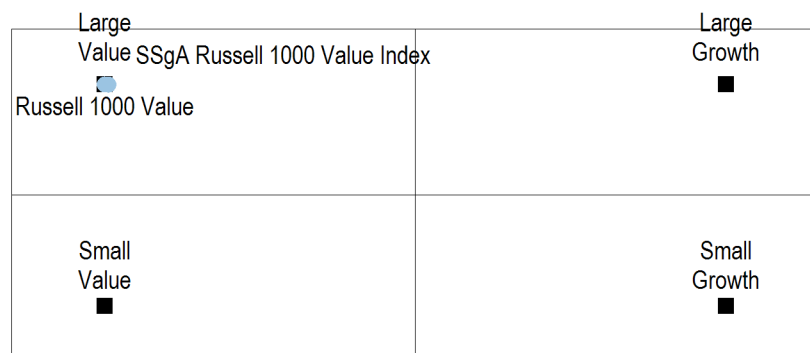
## Account Information

Account Name	SSgA Russell 1000 Value Index
Account Structure	Commingled Fund
Investment Style	Passive
Inception Date	7/01/05
Account Type	US Equity
Benchmark	Russell 1000 Value
Universe	Large Value MStar MF

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
SSgA Russell 1000 Value Index	1.4	17.8	4.0	9.5	7.9	11.5	7.4	Jul-05
Russell 1000 Value	1.4	17.8	4.0	9.4	7.8	11.5	7.4	Jul-05
Large Value MStar MF Median	1.6	17.2	2.5	9.8	7.5	11.0	7.4	Jul-05
Large Value MStar MF Rank	57	39	37	59	41	33	49	Jul-05

U.S. Effective Style Map  
3 Years Ending September 30, 2019



## SSgA Russell 1000 Value Index Characteristics

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
<b>Market Value</b>			
Market Value (\$M)	34.7	--	34.2
Number Of Holdings	758	760	718
<b>Sector Distribution</b>			
Energy	8.4	8.6	9.0
Materials	4.3	4.3	4.0
Industrials	9.5	9.5	8.0
Consumer Discretionary	6.1	6.0	5.3
Consumer Staples	9.2	8.9	7.8
Health Care	12.4	12.5	15.2
Financials	23.6	23.7	22.4
Information Technology	6.1	6.1	9.7
Communication Services	8.1	8.2	7.1
Utilities	7.0	6.7	6.4
Real Estate	5.3	5.4	5.1
<b>Company Size Distribution</b>			
Weighted Avg. Market Cap. (\$B)	115.8	114.2	122.9
Median Market Cap. (\$B)	9.0	9.0	9.2
Large Cap. (%)	37.9	37.0	40.6
Medium/Large Cap. (%)	30.9	31.5	28.9
Medium Cap. (%)	20.0	20.5	20.3
Medium/Small Cap. (%)	10.2	9.8	9.2
Small Cap. (%)	0.9	1.2	1.0

## SSgA S&amp;P Midcap 400 Index

As of September 30, 2019

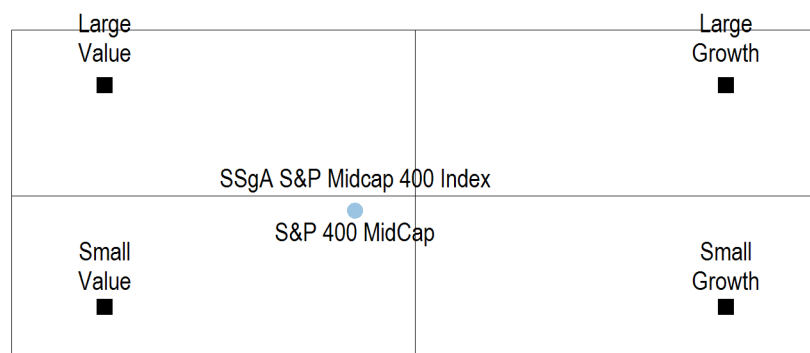
## Account Information

Account Name	SSgA S&P Midcap 400 Index
Account Structure	Commingled Fund
Investment Style	Passive
Inception Date	9/01/06
Account Type	US Equity
Benchmark	S&P 400 MidCap
Universe	Mid Cap MStar MF

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
SSgA S&P Midcap 400 Index	-0.1	17.9	-2.5	9.4	8.9	12.6	9.2	Sep-06
S&P 400 MidCap	-0.1	17.9	-2.5	9.4	8.9	12.6	9.2	Sep-06
Mid Cap MStar MF Median	-0.2	20.7	0.6	10.2	8.5	12.0	8.5	Sep-06
Mid Cap MStar MF Rank	46	70	64	57	42	37	36	Sep-06

U.S. Effective Style Map  
3 Years Ending September 30, 2019



## SSgA S&amp;P Midcap 400 Index Characteristics

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
<b>Market Value</b>			
Market Value (\$M)	9.5	--	9.5
Number Of Holdings	401	400	400
<b>Characteristics</b>			
Weighted Avg. Market Cap. (\$B)	5.8	5.8	5.8
Median Market Cap (\$B)	4.1	4.1	4.1
P/E Ratio	20.0	19.8	19.8
Yield	1.7	1.7	1.7
EPS Growth - 5 Yrs.	11.0	10.9	10.6
Price to Book	2.7	2.7	2.6
Beta (holdings; domestic)	1.1	1.1	1.2
<b>Sector Distribution</b>			
Energy	2.2	2.6	3.1
Materials	6.1	6.3	6.4
Industrials	15.9	15.6	15.9
Consumer Discretionary	12.5	13.1	12.3
Consumer Staples	2.8	2.7	2.7
Health Care	9.8	9.6	9.7
Financials	16.8	16.4	16.9
Information Technology	15.2	15.3	15.7
Communication Services	2.4	2.5	2.5
Utilities	4.9	4.8	4.7
Real Estate	11.4	11.0	10.1

## Lee Munder Small Cap Value

As of September 30, 2019

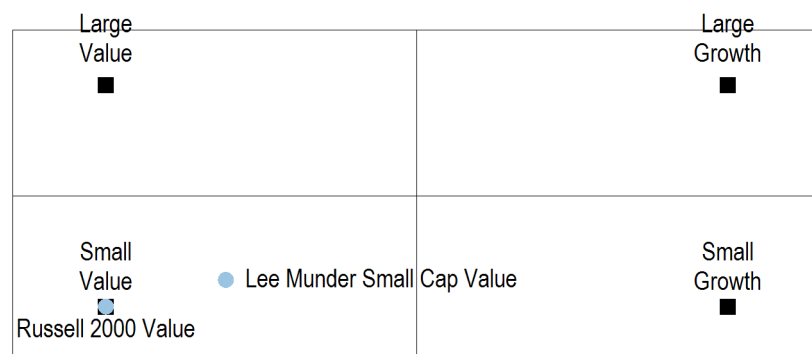
## Account Information

Account Name	Lee Munder Small Cap Value
Account Structure	Separate Account
Investment Style	Active
Inception Date	11/01/09
Account Type	US Equity
Benchmark	Russell 2000 Value
Universe	Small Value MStar MF

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Lee Munder Small Cap Value	0.4	17.6	-4.5	7.4	8.8	--	11.5	Nov-09
Russell 2000 Value	-0.6	12.8	-8.2	6.5	7.2	10.1	10.9	Nov-09
Small Value MStar MF Median	-0.9	12.9	-8.7	5.7	5.6	9.9	10.5	Nov-09
Small Value MStar MF Rank	27	15	14	17	9	--	26	Nov-09

U.S. Effective Style Map  
3 Years Ending September 30, 2019



## Lee Munder Small Cap Value Characteristics

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
<b>Market Value</b>			
Market Value (\$M)	12.0	--	12.0
Number Of Holdings	92	1387	92
<b>Sector Distribution</b>			
Energy	2.2	6.4	2.1
Materials	10.6	4.6	11.6
Industrials	21.3	12.7	21.7
Consumer Discretionary	6.5	9.8	6.3
Consumer Staples	11.2	2.5	11.4
Health Care	2.6	5.0	3.5
Financials	20.4	30.2	18.9
Information Technology	11.8	8.9	10.9
Communication Services	2.2	2.5	3.2
Utilities	5.2	6.2	4.8
Real Estate	4.2	11.3	4.1
<b>Company Size Distribution</b>			
Weighted Avg. Market Cap. (\$B)	3.1	2.0	3.2
Median Market Cap. (\$B)	2.5	0.6	2.7
Large Cap. (%)	0.0	0.0	0.0
Medium/Large Cap. (%)	0.0	0.0	0.0
Medium Cap. (%)	0.7	0.0	0.0
Medium/Small Cap. (%)	47.4	19.6	48.1
Small Cap. (%)	51.9	80.4	51.9

## SSgA MSCI EAFE Index

As of September 30, 2019

## Account Information

Account Name	SSgA MSCI EAFE Index
Account Structure	Commingled Fund
Investment Style	Passive
Inception Date	9/01/04
Account Type	Non-US Stock Developed
Benchmark	MSCI EAFE
Universe	Foreign MStar MF

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
SSgA MSCI EAFE Index	-1.0	13.2	-1.2	6.8	3.6	5.2	5.7	Sep-04
MSCI EAFE	-1.1	12.8	-1.3	6.5	3.3	4.9	5.4	Sep-04
Foreign MStar MF Median	-1.5	12.4	-2.8	5.7	3.3	5.4	5.9	Sep-04
Foreign MStar MF Rank	30	40	33	27	46	53	54	Sep-04

Non U.S. Effective Style Map vs. EAFE  
3 Years Ending September 30, 2019

Large Value ■	SSgA MSCI EAFE Index MSCI EAFE ●	Large Growth ■
Small Value ■		Small Growth ■

## SSgA MSCI EAFE Index Characteristics

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
<b>Market Value</b>			
Market Value (\$M)	57.3	--	63.9
Number Of Holdings	939	922	942
<b>Sector Distribution</b>			
Energy	5.1	5.1	5.5
Materials	7.0	7.2	7.4
Industrials	14.7	14.8	14.8
Consumer Discretionary	11.2	11.4	11.1
Consumer Staples	12.0	11.8	11.6
Health Care	11.5	11.3	11.1
Financials	18.6	18.8	19.1
Information Technology	6.8	6.8	6.7
Communication Services	5.4	5.4	5.3
Utilities	3.8	3.7	3.7
Real Estate	3.3	3.5	3.4
<b>Company Size Distribution</b>			
Weighted Avg. Market Cap. (\$B)	60.3	59.7	61.2
Median Market Cap. (\$B)	9.8	9.9	10.0
Large Cap. (%)	73.2	73.1	73.1
Medium Cap. (%)	21.2	20.9	21.2
Small Cap. (%)	5.6	5.9	5.7



## Acadian Non-U.S. Small Cap Equity

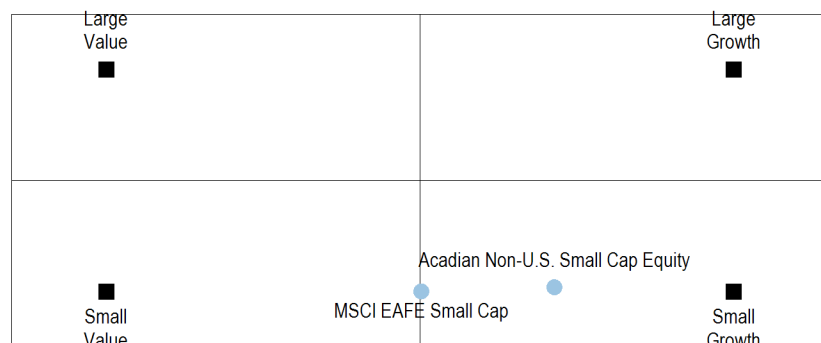
As of September 30, 2019

## Account Information

Account Name	Acadian Non-U.S. Small Cap Equity
Account Structure	Commingled Fund
Investment Style	Active
Inception Date	2/01/05
Account Type	Non-US Stock Developed
Benchmark	MSCI EAFE Small Cap
Universe	eV EAFE Small Cap Core Net

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Acadian Non-U.S. Small Cap Equity	-1.6	10.6	-8.7	6.2	6.5	8.7	7.5	Feb-05
MSCI EAFE Small Cap	-0.4	12.1	-5.9	5.9	6.0	7.5	6.2	Feb-05
eV EAFE Small Cap Core Net Median	-1.9	10.7	-7.9	5.6	5.5	8.7	7.5	Feb-05
eV EAFE Small Cap Core Net Rank	41	52	62	45	27	50	51	Feb-05

Non U.S. Effective Style Map vs. EAFE  
3 Years Ending September 30, 2019

## Acadian Non-U.S. Small Cap Equity Characteristics

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
<b>Market Value</b>			
Market Value (\$M)	23.2	--	23.6
Number Of Holdings	1443	2334	1441
<b>Characteristics</b>			
Weighted Avg. Market Cap. (\$B)	2.3	2.5	2.3
Median Market Cap (\$B)	0.5	1.0	0.5
P/E Ratio	12.9	15.6	12.7
Yield	2.8	2.9	2.8
EPS Growth - 5 Yrs.	14.3	11.2	15.8
Price to Book	2.0	2.1	2.1
Beta (holdings; domestic)	0.9	0.9	0.9
<b>Sector Distribution</b>			
Energy	2.2	2.7	3.1
Materials	9.2	8.1	10.1
Industrials	14.3	21.3	16.0
Consumer Discretionary	14.9	12.7	15.1
Consumer Staples	2.4	6.4	2.3
Health Care	11.0	7.4	12.4
Financials	12.6	10.5	10.1
Information Technology	16.8	9.7	15.8
Communication Services	4.8	5.2	4.9
Utilities	2.4	2.4	2.0
Real Estate	8.4	13.5	7.0

## PRIT Emerging Markets

As of September 30, 2019

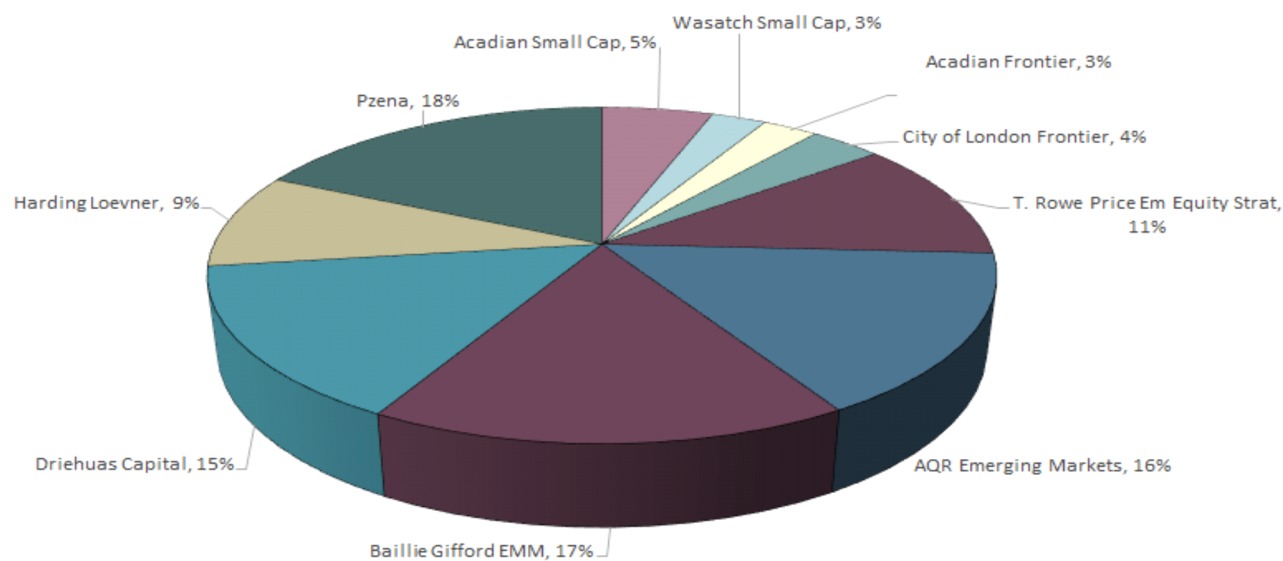
## Account Information

Account Name	PRIT Emerging Markets
Account Structure	Commingled Fund
Investment Style	Active
Inception Date	9/01/16
Account Type	Non-US Stock Emerging
Benchmark	MSCI Emerging Markets
Universe	eV Emg Mkts Equity Net

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
PRIT Emerging Markets	-3.6	8.6	-0.6	7.2	--	--	7.6	Sep-16
MSCI Emerging Markets	-4.2	5.9	-2.0	6.0	2.3	3.4	6.2	Sep-16
eV Emg Mkts Equity Net Median	-3.8	7.7	-0.6	5.7	2.5	4.0	5.9	Sep-16
eV Emg Mkts Equity Net Rank	45	42	51	27	--	--	26	Sep-16

## Manager Allocation



## IR&amp;M Aggregate Bond

As of September 30, 2019

## Account Information

Account Name	IR&M Aggregate Bond
Account Structure	Separate Account
Investment Style	Active
Inception Date	2/01/14
Account Type	US Fixed Income Investment Grade
Benchmark	BBgBarc US Aggregate TR
Universe	Intermediate Core Bond MStar MF

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
IR&M Aggregate Bond	2.4	8.9	10.6	3.2	3.6	--	3.8	Feb-14
BBgBarc US Aggregate TR	2.3	8.5	10.3	2.9	3.4	3.7	3.4	Feb-14
Intermediate Core Bond MStar MF Median	2.2	8.5	10.1	2.9	3.3	3.9	3.3	Feb-14
Intermediate Core Bond MStar MF Rank	14	31	16	26	14	--	9	Feb-14

## Statistics Summary

3 Years Ending September 30, 2019

	Anlzd Return	Anlzd Standard Deviation	Beta	Information Ratio	R-Squared
IR&M Aggregate Bond	3.19%	3.20%	0.95	0.95	0.99
BBgBarc US Aggregate TR	2.92%	3.35%	1.00	--	1.00

IR&M Aggregate Bond Characteristics  
vs. BBgBarc US Aggregate TR

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
Fixed Income Characteristics			
Yield to Maturity	2.4	2.3	2.7
Average Duration	5.7	6.3	5.6
Average Quality	AA	AA	AA
Weighted Average Maturity	8.1	13.1	8.1
US Sector Allocation			
UST/Agency	16.2	42.3	14.6
Corporate	32.8	25.1	32.5
MBS	29.5	28.9	40.9
ABS	7.6	0.5	8.1
Foreign	--	2.3	--
Muni	1.7	0.9	3.1
Cash	0.2	--	0.8
Credit Quality Allocation			
AAA	7.4	72.0	7.5
AA	55.0	3.5	53.6
A	9.2	10.7	10.0
BBB	19.2	13.9	18.8
Not Rated	9.1	--	9.3
Cash	0.1	--	0.8

## IR&amp;M Intermediate TIPS

As of September 30, 2019

## Account Information

Account Name	IR&M Intermediate TIPS
Account Structure	Separate Account
Investment Style	Active
Inception Date	2/01/14
Account Type	US Inflation Protected Fixed
Benchmark	BBgBarc US TIPS 1-10 Yr TR
Universe	Inflation-Protected Bond MStar MF

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
IR&M Intermediate TIPS	0.6	5.9	5.8	2.0	2.0	--	1.9	Feb-14
BBgBarc US TIPS 1-10 Yr TR	0.6	5.8	5.7	1.9	2.0	2.7	1.8	Feb-14
Inflation-Protected Bond MStar MF Median	1.1	7.4	5.9	2.1	2.0	3.1	2.0	Feb-14
Inflation-Protected Bond MStar MF Rank	69	65	58	57	53	--	64	Feb-14

## Statistics Summary

3 Years Ending September 30, 2019

	Anlzd Return	Anlzd Standard Deviation	Beta	Information Ratio	R-Squared
IR&M Intermediate TIPS	1.95%	2.32%	1.01	0.12	1.00
BBgBarc US TIPS 1-10 Yr TR	1.94%	2.29%	1.00	--	1.00

## IR&amp;M Intermediate TIPS Characteristics

vs. BBgBarc US TIPS TR

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
Fixed Income Characteristics			
Yield to Maturity	0.3	0.3	0.3
Average Duration	5.1	7.8	5.1
Average Quality	AAA	AAA	AAA
Weighted Average Maturity	5.2	8.4	5.2
US Sector Allocation			
UST/Agency	99.8	100.0	99.8
Cash	0.2	--	0.2
Credit Quality Allocation			
AAA	99.8	100.0	99.8
Cash	0.2	--	0.2

## Loomis Sayles - High Yield/Bank Loans

As of September 30, 2019

## Account Information

Account Name	Loomis Sayles - High Yield/Bank Loans
Account Structure	Separate Account
Investment Style	Active
Inception Date	1/01/96
Account Type	US Fixed Income High Yield
Benchmark	Credit Suisse Leveraged Loans
Universe	eV US High Yield Fixed Inc Gross

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Loomis Sayles - High Yield/Bank Loans	0.0	7.8	3.6	4.6	4.1	6.1	6.8	Jan-96
Credit Suisse Leveraged Loans	0.9	6.4	3.1	4.7	4.1	5.4	5.0	Jan-96
BBgBarc US High Yield TR	1.3	11.4	6.4	6.1	5.4	7.9	7.1	Jan-96
eV US High Yield Fixed Inc Gross Median	1.5	11.5	6.6	6.1	5.4	7.9	7.5	Jan-96
eV US High Yield Fixed Inc Gross Rank	96	87	93	94	91	98	91	Jan-96

## Statistics Summary

3 Years Ending September 30, 2019

	Anlzd Return	Anlzd Standard Deviation	Beta	Information Ratio	R-Squared
Loomis Sayles - High Yield/Bank Loans	4.62%	3.27%	1.09	-0.04	0.73
Credit Suisse Leveraged Loans	4.68%	2.56%	1.00	--	1.00

## Loomis Sayles - High Yield/Bank Loans Characteristics

vs. BBgBarc US High Yield TR

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
Fixed Income Characteristics			
Yield to Maturity	5.9	6.3	5.9
Average Duration	2.1	4.5	2.1
Average Quality	BB	B	BB
Weighted Average Maturity	4.9	5.8	5.0
US Sector Allocation			
Corporate	42.9	100.0	42.2
MBS	0.1	--	0.1
ABS	0.2	--	0.2
Foreign	0.8	--	1.0
Yankee	0.6	--	0.4
Other	51.0	--	51.8
Cash	4.5	--	4.3
Credit Quality Allocation			
AAA	4.6	--	4.4
AA	0.2	--	--
A	0.1	--	0.3
BBB	3.0	--	2.8
BB	45.9	47.8	43.7
B	39.0	38.7	42.1
CCC	7.0	12.7	5.0
CC	--	0.6	0.1
C	--	0.0	0.4

## Lazard Emerging Market Debt Blend

As of September 30, 2019

## Account Information

Account Name	Lazard Emerging Market Debt Blend
Account Structure	Commingled Fund
Investment Style	Active
Inception Date	8/01/13
Account Type	International Emerging Market Debt
Benchmark	50% JPM EMBI GD / 50% JPM GBI-EM
Universe	Emerging Markets Bond MStar MF

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Lazard Emerging Market Debt Blend	-0.3	11.1	10.7	3.2	1.9	--	2.1	Aug-13
50% JPM EMBI GD / 50% JPM GBI-EM	0.4	10.4	10.9	3.9	3.2	4.7	3.2	Aug-13
Emerging Markets Bond MStar MF Median	0.2	10.2	9.4	4.0	4.3	5.9	4.5	Aug-13
Emerging Markets Bond MStar MF Rank	58	38	18	76	86	--	81	Aug-13

## Statistics Summary

3 Years Ending September 30, 2019

	Anlzd Return	Anlzd Standard Deviation	Beta	Information Ratio	R-Squared
Lazard Emerging Market Debt Blend	3.19%	8.87%	1.20	-0.38	0.98
50% JPM EMBI GD / 50% JPM GBI-EM	3.89%	7.32%	1.00	--	1.00

Lazard Emerging Market Debt Blend Characteristics  
vs. JP Morgan EMBI Global Diversified

	Portfolio Q3-19	Index Q3-19	Portfolio Q2-19
Fixed Income Characteristics			
Yield to Maturity	6.1	5.2	7.6
Average Duration	6.8	7.4	6.3
Average Quality	BB	BB	BB
Weighted Average Maturity	10.6	11.9	10.3
Credit Quality Allocation			
AAA	-2.8	--	-3.8
AA	4.3	5.8	3.9
A	16.9	12.0	20.4
BBB	37.9	32.0	37.7
BB	15.8	13.9	17.5
B	17.5	26.6	16.6
CCC	3.7	2.2	2.6
Not Rated	6.5	7.4	5.2

Negative allocations indicate collateral posted for derivative transactions.

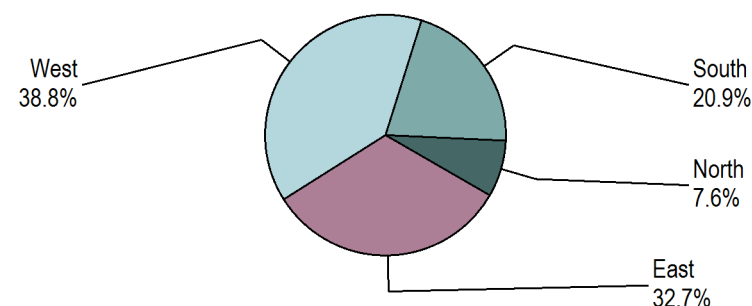
As of September 30, 2019

## Account Information

Account Name	PRIT Real Estate
Account Structure	Commingled Fund
Investment Style	Active
Inception Date	4/01/10
Account Type	Real Estate
Benchmark	NCREIF ODCE
Universe	

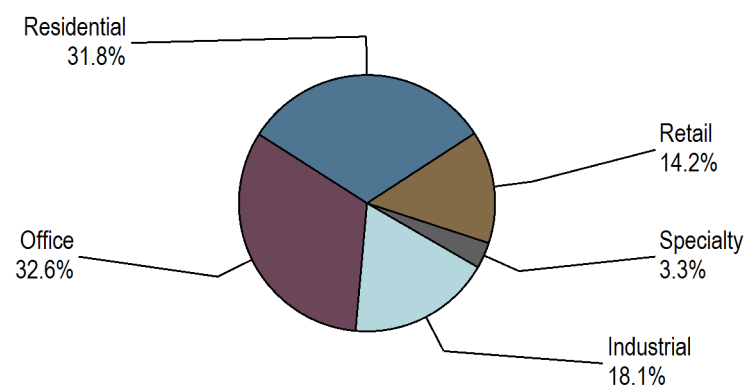
## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
PRIT Real Estate	2.5	7.9	6.6	7.0	9.4	--	11.0	Apr-10
NCREIF ODCE	1.3	3.8	5.6	7.3	9.3	10.9	11.8	Apr-10
NCREIF ODCE Equal Weighted	1.4	4.5	6.2	7.6	9.6	10.8	11.9	Apr-10
Custom Benchmark	2.0	7.0	7.3	7.3	9.3	10.9	11.6	Apr-10

Geographic Diversification  
Allocation as of September 30, 2019

Geographic Diversification: North refers to Midwest

## Property Type Allocation



Geographic and property type allocation are as of 9/30/2019



As of September 30, 2019

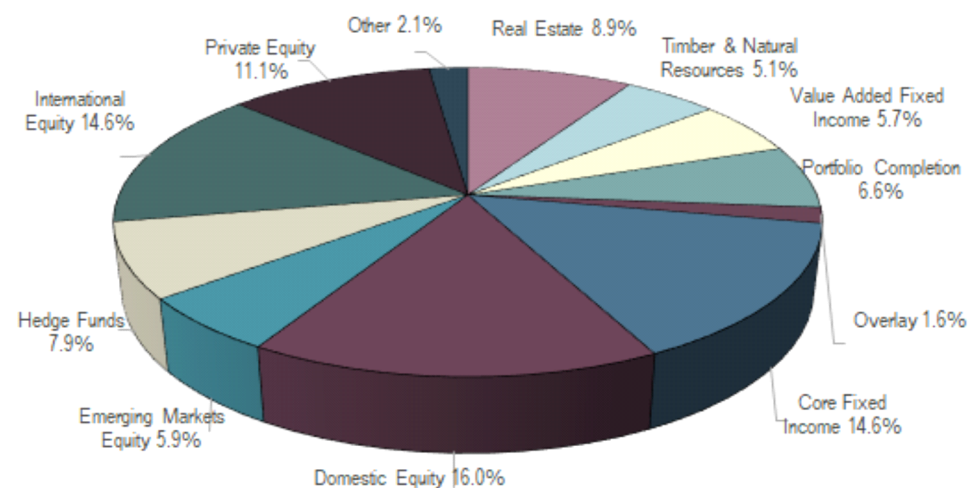
## Account Information

Account Name	PRIT General Allocation Fund
Account Structure	Commingled Fund
Investment Style	Passive
Inception Date	6/01/16
Account Type	Global Macro
Benchmark	60% MSCI ACWI / 40% Barclays Global Aggregate
Universe	

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
PRIT General Allocation Fund	1.3	11.2	4.2	8.3	--	--	9.0	Jun-16
60% MSCI ACWI / 40% Barclays Global Aggregate	0.3	12.4	4.2	6.6	4.9	6.1	7.2	Jun-16

## Manager Allocation





## SSgA Global Natural Resources Stock Index

As of September 30, 2019

## Account Information

Account Name	SSgA Global Natural Resources Stock Index
Account Structure	Commingled Fund
Investment Style	Passive
Inception Date	5/01/11
Account Type	Real Assets
Benchmark	S&P Global LargeMidCap Commodity and Resources NR USD
Universe	Natural Resources MStar MF

## Portfolio Performance Summary

	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
SSgA Global Natural Resources Stock Index	-6.0	7.4	-6.2	6.7	--	--	--	May-11
S&P Global LargeMidCap Commodity and Resources NR USD	-6.0	7.3	-6.3	6.3	-0.3	1.6	-2.6	May-11
Natural Resources MStar MF Median	-5.4	7.1	-15.3	1.3	-3.3	0.9	-3.1	May-11
Natural Resources MStar MF Rank	56	37	15	8	--	--	--	May-11

## Top 10 Holdings

NUTRIEN	5.9%
EXXON MOBIL	5.6%
ARCHER DANIELS MIDLAND	4.7%
BHP GROUP	4.4%
CORTEVA	4.3%
CHEVRON	4.3%
RIO TINTO	3.1%
TOTAL	2.5%
BP	2.4%
ROYAL DUTCH SHELL A(LON)	2.4%
<b>Total</b>	<b>39.6%</b>

## SSgA Global Natural Resources Stock Index Characteristics

	Portfolio Q3-19	Portfolio Q2-19
<b>Market Value</b>		
Market Value (\$M)	8.2	8.8
Number Of Holdings	178	211
<b>Characteristics</b>		
Weighted Avg. Market Cap. (\$B)	60.2	64.0
Median Market Cap (\$B)	8.9	9.4
P/E Ratio	14.2	14.5
Yield	3.7	3.5
EPS Growth - 5 Yrs.	1.4	1.5
Price to Book	1.7	1.7
Beta (holdings; domestic)	1.1	1.2

## Sector Distribution

Energy	34.0	32.6
Materials	53.6	55.0
Industrials	0.0	0.0
Consumer Discretionary	0.0	0.0
Consumer Staples	11.1	11.1
Health Care	0.0	0.0
Financials	0.0	0.0
Information Technology	0.0	0.0
Communication Services	0.0	0.0
Utilities	0.0	0.0
Real Estate	0.0	0.0

Worcester Retirement System  
Investment Expense Analysis

As of September 30, 2019

**Investment Expense Analysis**  
**As Of September 30, 2019**

Name	Fee Schedule	Market Value	Estimated Fee Value	Estimated Fee
<b>Total Retirement System</b>		<b>\$1,002,854,338</b>		
<b>Domestic Equity Assets</b>		<b>\$130,807,630</b>		
SSgA S&P 500 Index	0.0500% of First 50.0 Mil, 0.0400% of Next 50.0 Mil, 0.0200% Thereafter	\$39,323,500	\$19,662	0.05%
SSgA Russell 1000 Growth Index	0.0800% of First 50.0 Mil, 0.0600% of Next 50.0 Mil, 0.0400% Thereafter	\$35,305,353	\$28,244	0.08%
SSgA Russell 1000 Value Index	0.0800% of First 50.0 Mil, 0.0600% of Next 50.0 Mil, 0.0400% Thereafter	\$34,660,564	\$27,728	0.08%
SSgA S&P Midcap 400 Index	0.0800% of First 50.0 Mil, 0.0600% of Next 50.0 Mil, 0.0400% Thereafter	\$9,517,594	\$7,614	0.08%
Lee Munder Small Cap Value	0.9000% of Assets	\$12,000,618	\$108,006	0.90%
<b>International Developed Market Equity</b>		<b>\$80,456,137</b>		
SSgA MSCI EAFE Index	0.1000% of First 50.0 Mil, 0.0800% of Next 50.0 Mil, 0.0500% Thereafter	\$57,252,760	\$55,802	0.10%
Acadian Non-U.S. Small Cap Equity	0.7500% of Assets	\$23,203,377	\$174,025	0.75%
<b>International Emerging Market Equity</b>		<b>\$86,013,666</b>		
PRIT Emerging Markets	0.3100% of Assets	\$86,013,666	\$266,642	0.31%
<b>Fixed Income Assets</b>		<b>\$167,960,780</b>		
<b>Core Fixed Income</b>		<b>\$104,390,127</b>		
<b>Total Investment Grade Bonds</b>		<b>\$67,085,921</b>		
IR&M Aggregate Bond	0.2500% of First 75.0 Mil, 0.2000% Thereafter	\$67,085,921	\$167,715	0.25%
<b>TIPS</b>		<b>\$37,304,205</b>		
IR&M Intermediate TIPS	0.0500% of Assets	\$37,304,205	\$18,652	0.05%



Worcester Retirement System  
Investment Expense Analysis

As of September 30, 2019

Name	Fee Schedule	Market Value	Estimated Fee Value	Estimated Fee
<b>Value Added Fixed Income</b>		<b>\$63,570,653</b>		
Loomis Sayles High Yield	0.5000% of Assets	\$13,255,264	\$66,276	0.50%
Loomis Sayles Bank Loans	0.4700% of Assets	\$11,498,503	\$54,043	0.47%
<b>Total Emerging Markets Debt</b>		<b>\$30,772,778</b>		
Lazard Emerging Market Debt Blend	0.8500% of Assets	\$30,772,778	\$261,569	0.85%
<b>Mezzanine Debt</b>		<b>\$8,044,108</b>		
Northstar Mezzanine Partners VI	2.0% management fee; 20.0% carried interest; 8% preferred return	\$5,365,617		
Newstone Capital Partners II	Management Fee: 1.5% of commitments during the investment period; thereafter, 1% of invested capital, less permanent write-downs and principal repayments Preferred Return: 8% Carried Interest: 20%	\$689,111		
Northstar Mezzanine Partners V	2.0% management fee; 20.0% carried interest; 8% preferred return	\$1,767,175		
Northstar Mezzanine Partners IV	2.0% management fee; 20.0% carried interest; 8% preferred return	\$143,213		
Newstone Capital Partners	1.5% management fee; 8% preferred return; 20% carried interest	\$0		
Northstar Mezzanine Partners III	2.0% management fee; 20.0% carried interest; 8% preferred return	\$78,992		
<b>Real Estate</b>		<b>\$73,353,658</b>		
<b>Open-End Real Estate</b>		<b>\$69,454,107</b>		
PRIT Real Estate	0.6400% of Assets	\$69,454,107	\$444,506	0.64%
<b>Non-Core Real Estate</b>		<b>\$3,899,551</b>		
AEW Partners VII	1.25% management fee, 9% preferred return, 20% carried interest	\$3,899,551		
AEW Partners VI	1.0% on committed capital during the investment period; 1.0% on net invested equity capital thereafter; 20% carried interest; 9% preferred return	\$0		

Worcester Retirement System  
Investment Expense Analysis

As of September 30, 2019

Name	Fee Schedule	Market Value	Estimated Fee Value	Estimated Fee
<b>Private Equity</b>		<b>\$78,305,433</b>		
<b>Buyouts</b>		<b>\$46,784,971</b>		
American Securities Partners VI	\$3 billion target; \$5 million minimum for individual investors and \$10 million minimum for institutional investors. 80/20 carry	\$3,686,350		
Riverside Capital Appreciation Fund VI	2 % management fee , 8% preferred return, 20% carried interest	\$5,511,033		
Vitruvian Investment Partnership I	2.0% management fee; 8% preferred return; 20% carried interest	\$1,467,759		
Riverside Micro Cap Fund III	2.0% management fee; 8% preferred; 20% carry	\$9,416,166		
Ridgemont II	Performance-based 2.0000 and 20.0000	\$10,258,824	\$398,813	3.89%
Capital International Private Equity Fund VI	80/20 carry 1.5% management fee \$2.5 billion target	\$6,411,290		
Harvest Partners V	2.0% management fee; 20% carried interest; 8% preferred return	\$736,500		
TA XII	Performance-based 1.6500 and 20.0000	\$8,208,784	\$364,742	4.44%
Riverside Capital Fund V	2.25% management fee; 8% preferred return; 20% carried interest	\$668,749		
Riverside Europe III	2.5% management fee; 8% preferred return; 20% carried interest	\$201,648		
Charlesbank Equity Fund VI	2.0% of commitments during commitment period; 2.0% of funded commitments afterwards; 20.0% carried interest; 8.0% preferred return	\$217,868		
<b>Fund of Funds</b>		<b>\$21,716,496</b>		
PRIT Vintage Year 2016	1.0000% of Assets	\$5,194,158	\$51,942	1.00%
PRIT Vintage Year 2017	1.0000% of Assets	\$9,819,561	\$98,196	1.00%

## Investment Expense Analysis

As of September 30, 2019

Name	Fee Schedule	Market Value	Estimated Fee Value	Estimated Fee
European Strategic Partners	Management fee: 0.75% of undrawn commitment, 1.0% of drawn commitment; Carried interest: 15.0% on direct investments and 5.0% on fund investments; 8.0% preferred return	\$73,604		
<b>INVESCO Private Capital II</b>	<b>Management Fee: 0.50% for Buyout Fund (40%); 1.0% for Venture Fund (30%); 1.0% for Non-U.S. Fund (30%); discounted to an aggregate 0.75% on Diversified Portfolio</b>	<b>\$40,740</b>		
INVESCO US Buyout	0.5000% of Assets	\$35,504	\$178	0.50%
INVESCO Venture	1.0000% of Assets	\$5,236	\$52	1.00%
PRIT Vintage Year 2018	1.0000% of Assets	\$5,160,430	\$51,604	1.00%
PRIT Vintage Year 2019	1.0000% of Assets	\$1,428,004	\$14,280	1.00%
<b>Venture Capital Funds</b>		<b>\$9,803,966</b>		
Ascent Venture Partners V	2.50% of commitments; 20 % carried Interest	\$4,274,284		
Asecent Venture Partners VI	2.50% of commitments; 20% carried interest	\$4,335,993		
Boston Millennia Partners III	1.5% of reported value; 20% carried interest	\$483,341		
Boston Millennia Partners II	1.25% management fee	\$449,367		
Ascent Venture Partners IV	2.50% of commitments; 20% carried interest	\$47,988		
Ascent Venture Partners III	2.25% of commitments; 20% carried interest	\$190,312		
<b>PRIT General Allocation</b>		<b>\$306,011,838</b>		
PRIT General Allocation Fund	0.5300% of Assets	\$306,011,838	\$1,621,863	0.53%
<b>Real Assets</b>		<b>\$78,505,873</b>		

Worcester Retirement System  
Investment Expense Analysis

As of September 30, 2019

Name	Fee Schedule	Market Value	Estimated Fee Value	Estimated Fee
<b>Natural Resources Assets</b>		<b>\$14,748,363</b>		
<b>Natural Resources (Public)</b>		<b>\$8,228,171</b>		
SSgA Global Natural Resources Stock Index	0.1500% of Assets	\$8,228,171	\$12,342	0.15%
<b>Natural Resources (Private)</b>		<b>\$6,520,192</b>		
White Deer Energy II	2% Management Fee, 20% Carried Interest, 8% Preferred Return	\$6,166,742		
White Deer Energy	2% of commitments during the investment period; thereafter, 2% of contributions net of realized investments and writedowns; 8% preferred return; 20% carried interest	\$353,450		
<b>Timber</b>		<b>\$8,712,715</b>		
RMK Select Timberland Investment Fund I	1.00% management fee; 15.0% incentive fee collected at end on returns in excess of a net real IRR of 8.0%.	\$4,394,734		
Hancock Timberland VII	Management fee: 0.95% on committed capital; 20% carried interest; 8% preferred return	\$1,523,353		
RMK Select Timberland Investment Fund II	100 bp management fee; 15.0% incentive fee collected at end on returns in excess of a net real IRR of 8.0%	\$2,794,628		
RMK Balanced Timberland B	1.00% management fee; 15.0% incentive fee collected at end on returns in excess of a net real IRR of 8.0%	\$0		
<b>Infrastructure</b>		<b>\$55,044,796</b>		
IFM Global Infrastructure	Performance-based 0.7700 and 8.0000	\$41,381,716	\$408,734	0.99%
Global Infrastructure Partners	2.0% management fee; 20% carried interest; 8% preferred return	\$959,583		
Global Infrastructure Partners III	1.75% of a capital commitment up to \$75 million during commitment period 1.75% of invested capital deemed outstanding after commitment period	\$12,564,400		
Global Infrastructure Partners IV, L.P.		\$139,096		
<b>Cash</b>		<b>\$1,439,325</b>		
Cash		\$1,439,325		



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PERFORMANCE DATA CONTAINED HEREIN REPRESENT PAST PERFORMANCE. PAST PERFORMANCE IS NO GUARANTEE OF FUTURE RESULTS.



**Credit Risk:** Refers to the risk that the issuer of a fixed income security may default (i.e., the issuer will be unable to make timely principal and/or interest payments on the security.)

**Duration:** Measure of the sensitivity of the price of a bond to a change in its yield to maturity. Duration summarizes, in a single number, the characteristics that cause bond prices to change in response to a change in interest rates. For example, the price of a bond with a duration of three years will rise by approximately 3% for each 1% decrease in its yield to maturity. Conversely, the price will decrease 3% for each 1% increase in the bond's yield. Price changes for two different bonds can be compared using duration. A bond with a duration of six years will exhibit twice the percentage price change of a bond with a three-year duration. The actual calculation of a bond's duration is somewhat complicated, but the idea behind the calculation is straightforward. The first step is to measure the time interval until receipt for each cash flow (coupon and principal payments) from a bond. The second step is to compute a weighted average of these time intervals. Each time interval is measured by the present value of that cash flow. This weighted average is the duration of the bond measured in years.

**Information Ratio:** This statistic is a measure of the consistency of a portfolio's performance relative to a benchmark. It is calculated by subtracting the benchmark return from the portfolio return (excess return), and dividing the resulting excess return by the standard deviation (volatility) of this excess return. A positive information ratio indicates outperformance versus the benchmark, and the higher the information ratio, the more consistent the outperformance.

**Jensen's Alpha:** A measure of the average return of a portfolio or investment in excess of what is predicted by its beta or "market" risk.  $\text{Portfolio Return} - [\text{Risk Free Rate} + \text{Beta} * (\text{market return} - \text{Risk Free Rate})]$ .

**Market Capitalization:** For a firm, market capitalization is the total market value of outstanding common stock. For a portfolio, market capitalization is the sum of the capitalization of each company weighted by the ratio of holdings in that company to total portfolio holdings; thus it is a weighted-average capitalization. Meketa Investment Group considers the largest 65% of the broad domestic equity market as large capitalization, the next 25% of the market as medium capitalization, and the smallest 10% of stocks as small capitalization.

**Market Weighted:** Stocks in many indices are weighted based on the total market capitalization of the issue. Thus, the individual returns of higher market-capitalization issues will more heavily influence an index's return than the returns of the smaller market-capitalization issues in the index.

**Maturity:** The date on which a loan, bond, mortgage, or other debt/security becomes due and is to be paid off.

**Prepayment Risk:** The risk that prepayments will increase (homeowners will prepay all or part of their mortgage) when mortgage interest rates decline; hence, investors' monies will be returned to them in a lower interest rate environment. Also, the risk that prepayments will slow down when mortgage interest rates rise; hence, investors will not have as much money as previously anticipated in a higher interest rate environment. A prepayment is any payment in excess of the scheduled mortgage payment.

**Price-Book Value (P/B) Ratio:** The current market price of a stock divided by its book value per share. Meketa Investment Group calculates P/B as the current price divided by Compustat's quarterly common equity. Common equity includes common stock, capital surplus, retained earnings, and treasury stock adjusted for both common and nonredeemable preferred stock. Similar to high P/E stocks, stocks with high P/B's tend to be riskier investments.

**Price-Earnings (P/E) Ratio:** A stock's market price divided by its current or estimated future earnings. Lower P/E ratios often characterize stocks in low growth or mature industries, stocks in groups that have fallen out of favor, or stocks of established blue chip companies with long records of stable earnings and regular dividends. Sometimes a company that has good fundamentals may be viewed unfavorably by the market if it is an industry that is temporarily out of favor. Or a business may have experienced financial problems causing investors to be skeptical about its future. Either of these situations would result in lower relative P/E ratios. Some stocks exhibit above-average sales and earnings growth or expectations for above average growth. Consequently, investors are willing to pay more for these companies' earnings, which results in elevated P/E ratios. In other words, investors will pay more for shares of companies whose profits, in their opinion, are expected to increase faster than average. Because future events are in no way assured, high P/E stocks tend to be riskier and more volatile investments. Meketa Investment Group calculates P/E as the current price divided by the I/B/E/S consensus of twelve-month forecast earnings per share.

**Quality Rating:** The rank assigned a security by such rating services as Fitch, Moody's, and Standard & Poor's. The rating may be determined by such factors as (1) the likelihood of fulfillment of dividend, income, and principal payment of obligations; (2) the nature and provisions of the issue; and (3) the security's relative position in the event of liquidation of the company. Bonds assigned the top four grades (AAA, AA, A, BBB) are considered investment grade because they are eligible bank investments as determined by the controller of the currency.

**Sharpe Ratio:** A commonly used measure of risk-adjusted return. It is calculated by subtracting the risk free return (usually three-month Treasury bill) from the portfolio return and dividing the resulting excess return by the portfolio's total risk level (standard deviation). The result is a measure of return per unit of total risk taken. The higher the Sharpe ratio, the better the fund's historical risk adjusted performance.

**Standard Deviation:** A measure of the total risk of an asset or a portfolio. Standard deviation measures the dispersion of a set of numbers around a central point (e.g., the average return). If the standard deviation is small, the distribution is concentrated within a narrow range of values. For a normal distribution, about two thirds of the observations will fall within one standard deviation of the mean, and 95% of the observations will fall within two standard deviations of the mean.

**STIF Account:** Short-term investment fund at a custodian bank that invests in cash-equivalent instruments. It is generally used to safely invest the excess cash held by portfolio managers.

**Style:** The description of the type of approach and strategy utilized by an investment manager to manage funds. For example, the style for equities is determined by portfolio characteristics such as price-to-book value, price-to-earnings ratio, and dividend yield. Equity styles include growth, value, and core.

**Yield to Maturity:** The yield, or return, provided by a bond to its maturity date; determined by a mathematical process, usually requiring the use of a “basis book.” For example, a 5% bond pays \$5 a year interest on each \$100 par value. To figure its current yield, divide \$5 by \$95—the market price of the bond—and you get 5.26%. Assume that the same bond is due to mature in five years. On the maturity date, the issuer is pledged to pay \$100 for the bond that can be bought now for \$95. In other words, the bond is selling at a discount of 5% below par value. To figure yield to maturity, a simple and approximate method is to divide 5% by the five years to maturity, which equals 1% pro rata yearly. Add that 1% to the 5.26% current yield, and the yield to maturity is roughly 6.26%.

$$\frac{5\% \text{ (discount)}}{5 \text{ (yrs. to maturity)}} = 1\% \text{ pro rata, plus } 5.26\% \text{ (current yield)} = 6.26\% \text{ (yield to maturity)}$$

Sources: Investment Terminology, International Foundation of Employee Benefit Plans, 1999.  
The Handbook of Fixed Income Securities, Fabozzi, Frank J., 1991.

## Benchmark Notes

### Custom Benchmark

Custom Benchmark is composed of 23% Russell 3000, 22% MSCI ACWI ex US, 6% Cambridge Associates Fund of Funds Composites 1q lagged, 7% Barclays Aggregate, 6% Barclays High Yield, 3% blended benchmark comprised of 50% JPM EMBI GD 50% JPM GBI-EM, 6% Barclays US TIPS, 3% NCREIF Timberland, 10% NCREIF ODCE, 2% DJ Brookfield Global Infrastructure, 7% of a blended benchmark comprising 60% MSCI ACWI and 40% Barclays Global Aggregate Bond indices, 2% S&P North American Natural Resources Sector and 2% HFRI Fund of Funds Composite.

### Spliced Benchmark

60% MSCI ACWI and 40% Barclays Global Aggregate Bond indexes since June 2015, Barclay's US Tips 1-10 Year prior.

### SSgA MSCI EAFE

SSgA MSCI EAFE index fund performance is based on the aggregate of the daily liquidity fund and the semi-monthly liquidity fund.

### PRIT Real Estate

PRIT Real Estate inception date shown is based on the first full quarter invested.

### Custom Real Estate Benchmark

Custom Benchmark is composed of 80% NCREIF ODCE, 10% NAREIT Equity and 10% FTSE EPRA NAREIT Developed ex. U.S. REIT.

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Throughout this report, numbers may not sum due to rounding.

Returns for periods greater than one year are annualized throughout this report.

Values shown are in millions of dollars, unless noted otherwise.