

Montana Board of Investments

CEM Benchmarking Results

(for the 5-year period ending December 31, 2015)



Mike Heale, Principal
mike@cembenchmarking.com
416 369-0468

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This benchmarking report compares your cost and return performance to CEM's extensive pension database.

- 131 U.S. pension funds participate. The median U.S. fund had assets of \$7.4 billion and the average U.S. fund had assets of \$20.8 billion. Total participating U.S. assets were \$2.7 trillion.

- 56 Canadian funds participate with assets totaling \$657 billion.

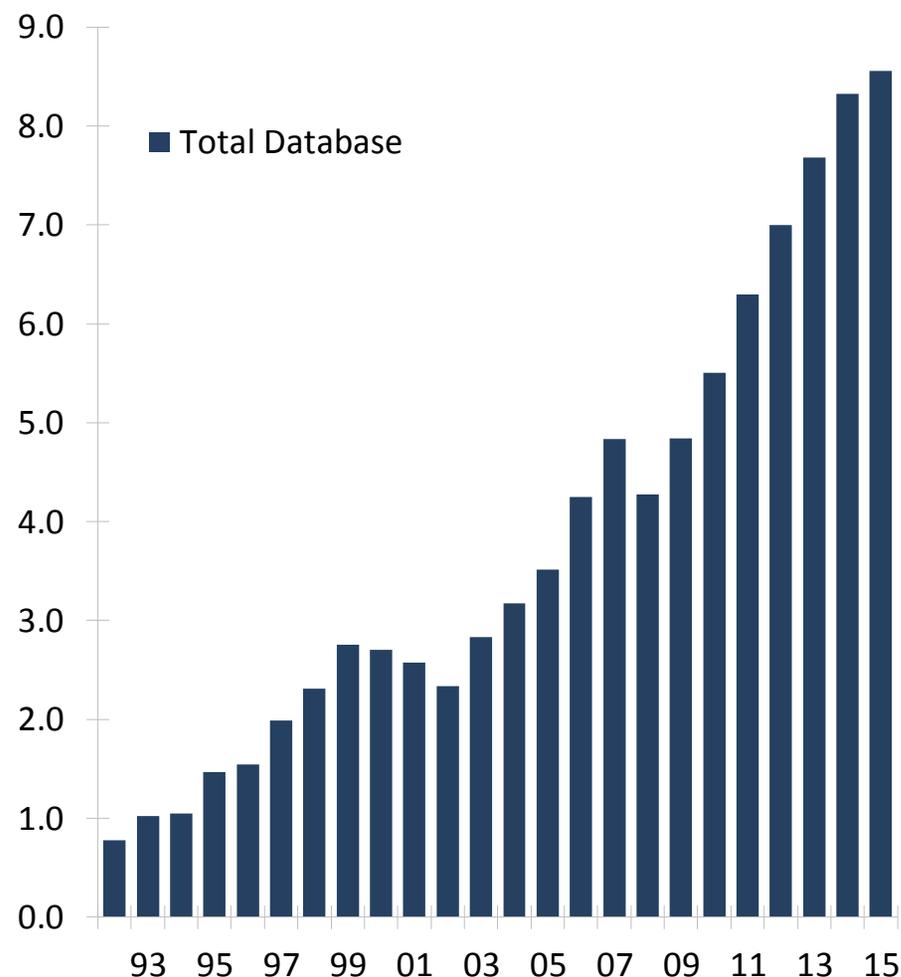
- 28 European funds participate with aggregate assets of \$1.8 trillion. Included are funds from the Netherlands, Norway, Sweden, Finland, Ireland, Denmark and the U.K.

- 6 Asia-Pacific funds participate with aggregate assets of \$185 billion. Included are funds from Australia, New Zealand, China and South Korea.

- 2 Gulf region funds participate.

The most meaningful comparisons for your returns and value added are to the U.S. Public universe which consists of 50 funds.

Participating assets (\$ trillions)

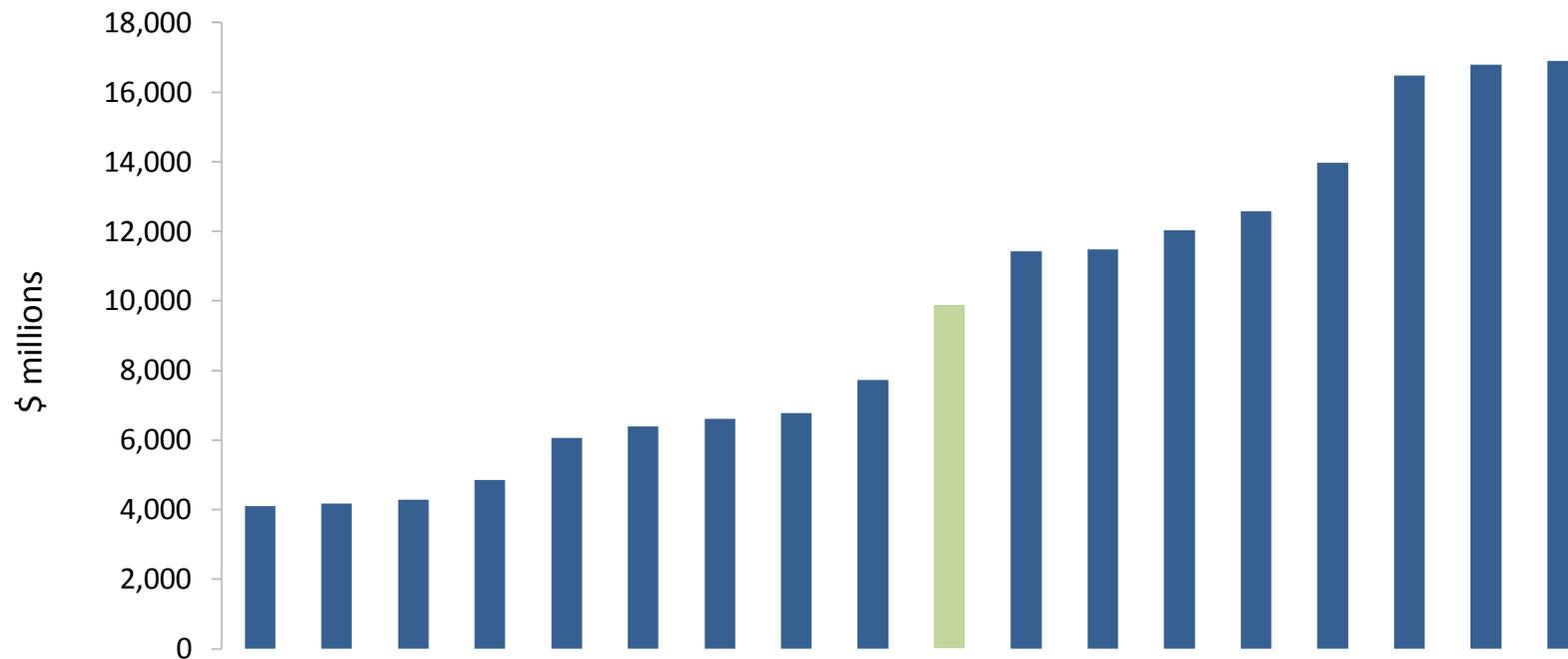


* 2015 reflects both received and expected data.

The most valuable comparisons for cost performance are to your custom peer group because size impacts costs.

Peer group for Montana Board of Investments

- 18 U.S. public sponsors from \$4.1 billion to \$16.9 billion
 - Median size of \$8.8 billion versus your \$9.9 billion



To preserve client confidentiality, given potential access to documents as permitted by the Freedom of Information Act, we do not disclose your peers' names in this document.

What gets measured gets managed, so it is critical that you measure and compare the right things:

1. Returns

Why do total returns differ from other funds? Asset mix is the most important driver of total returns. What was the impact of your policy asset mix decisions?

2. Implementation Impact

How does your implementation impact your total returns?

3. Costs

Are your costs reasonable? Costs matter and can be managed.

4. Cost effectiveness

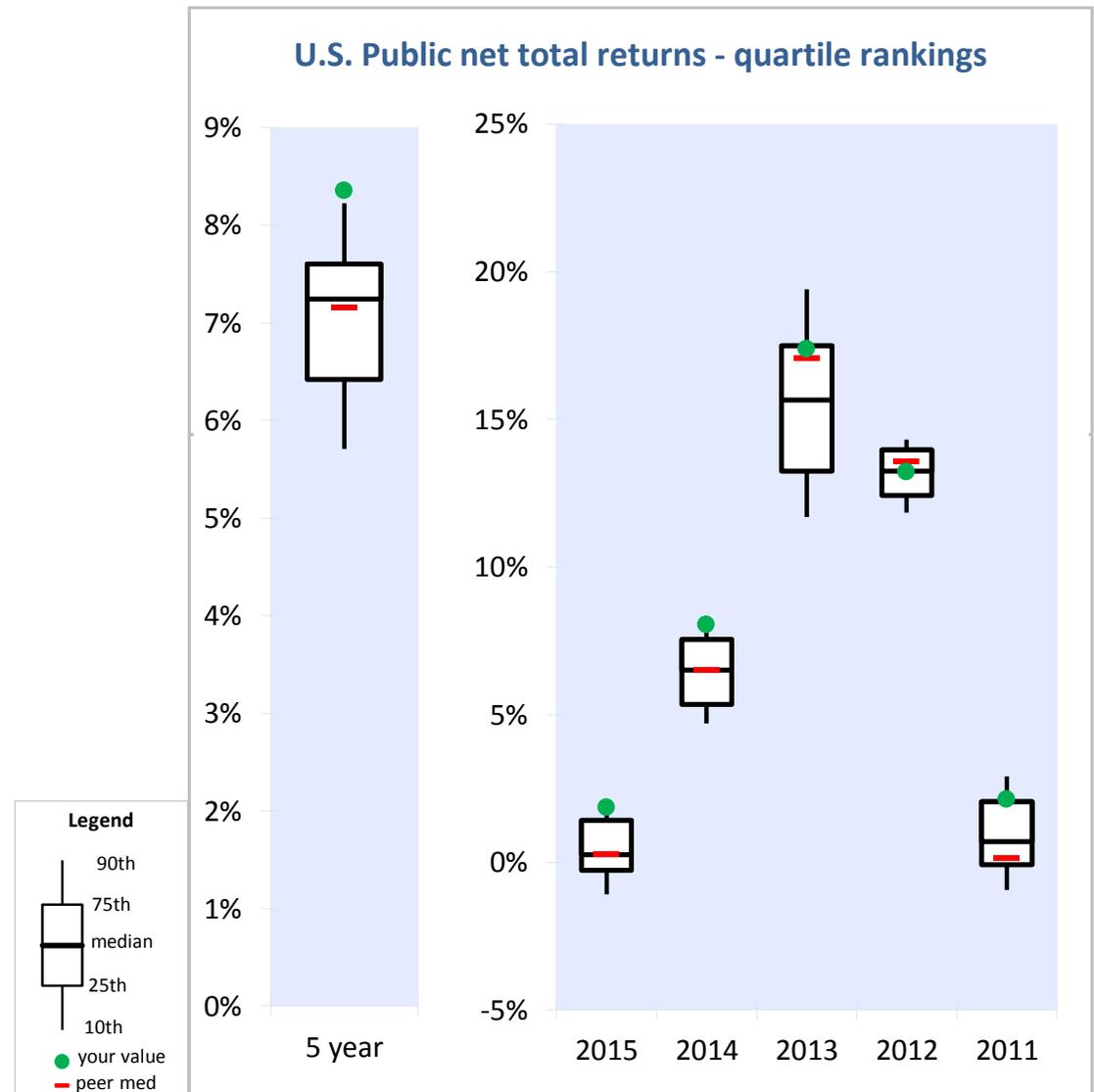
Implementation impact versus excess cost. Does paying more get you more?

Your 5-year net total return of 8.4% was above both the U.S. Public median of 7.2% and the peer median of 7.2%.

Total returns, by themselves, provide little insight into the reasons behind relative performance. Therefore, we separate total return into its more meaningful components: policy return and implementation impacts.

	Your 5-year
Net total fund return	8.4%
- Policy return	7.9%
= Implementation impacts	0.5%

This approach enables you to understand the contribution from both policy mix decisions (by far the most important driver of total return) and implementation impacts.



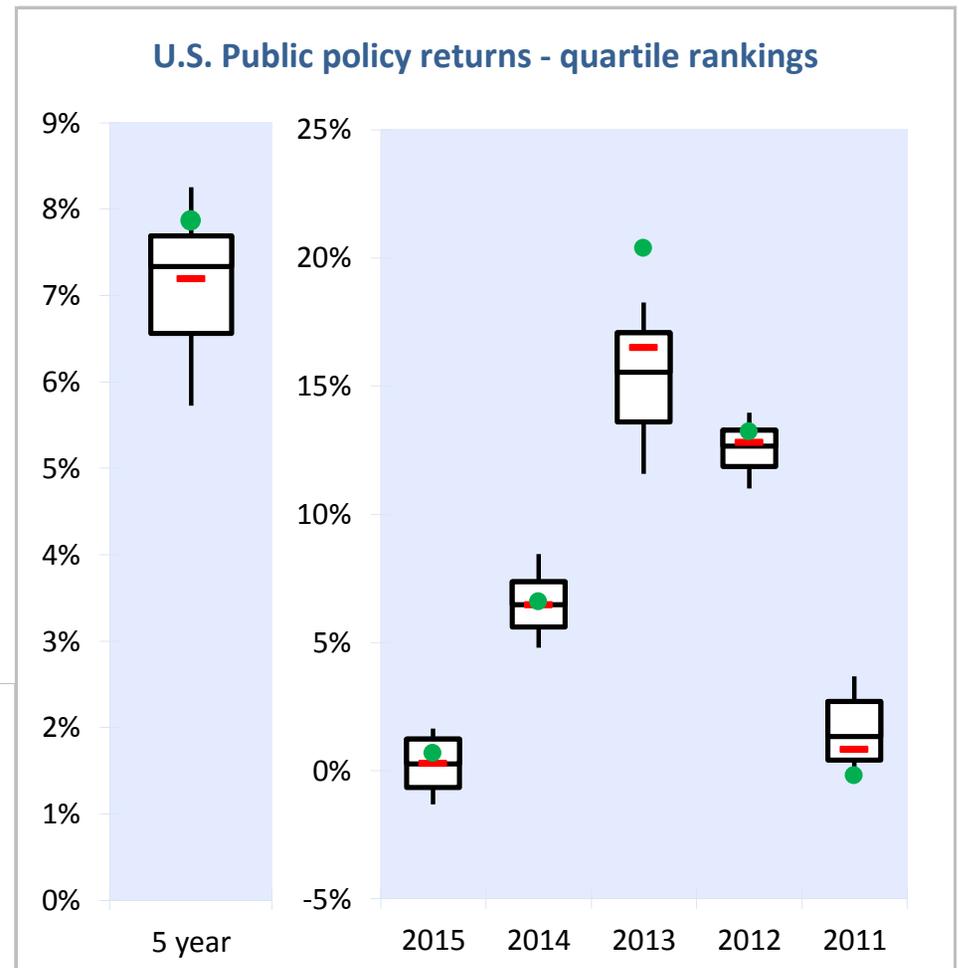
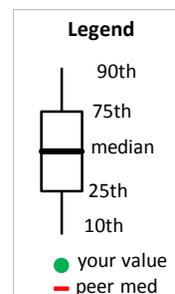
Your 5-year policy return of 7.9% was above both the U.S. Public median of 7.3% and the peer median of 7.2%.

Your policy return is the return you could have earned passively by indexing your investments according to your policy mix.

Having a higher or lower relative policy return is not necessarily good or bad. Your policy return reflects your investment policy, which should reflect your:

- Long term capital market expectations
- Liabilities
- Appetite for risk

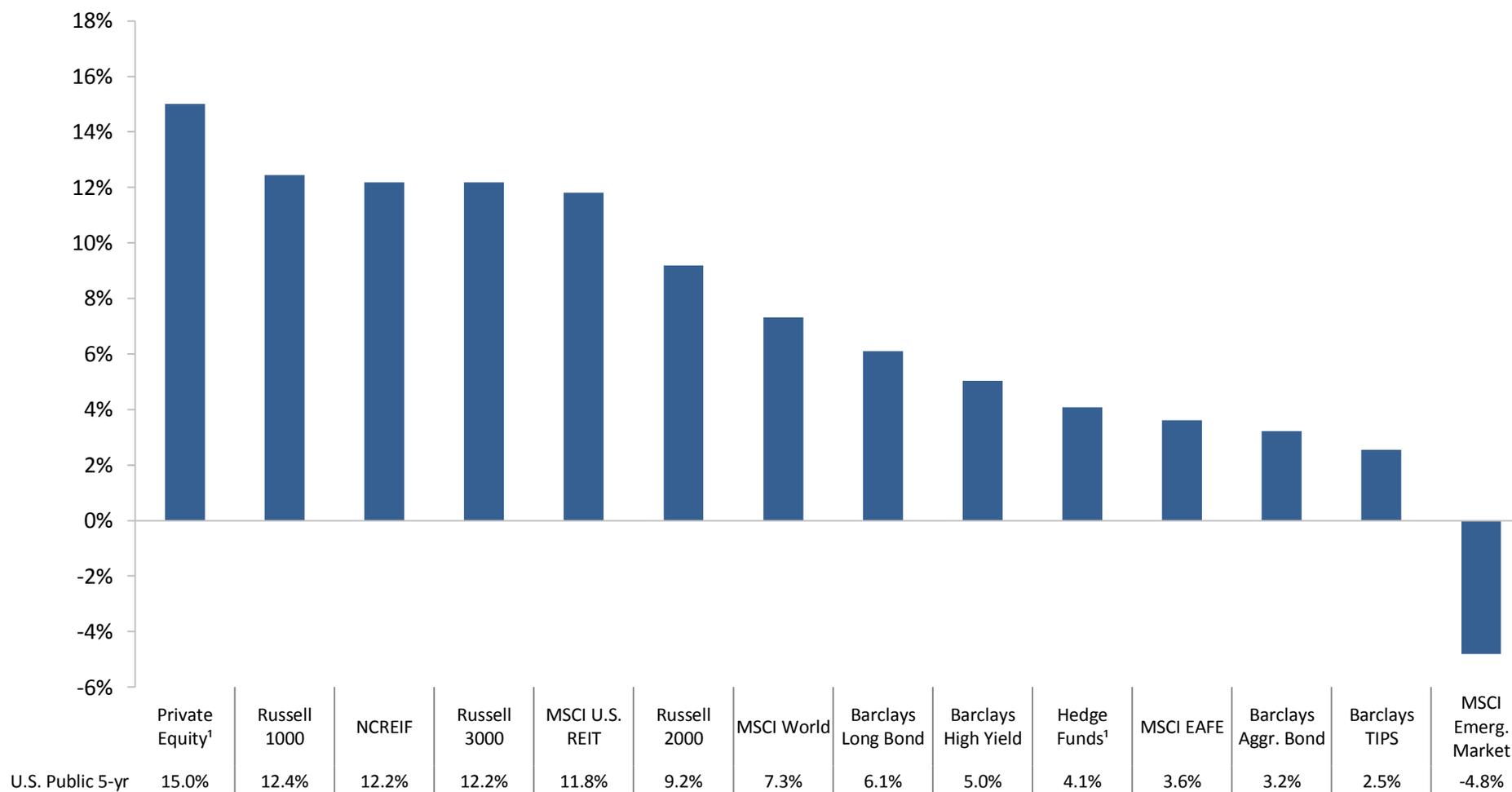
Each of these three factors is different across funds. Therefore, it is not surprising that policy returns often vary widely between funds.



To enable fairer comparisons, the policy returns of all participants including your fund were adjusted to reflect private equity benchmarks based on lagged, investable, public-market indices. Your custom lag was 0 days. Prior to this adjustment, your 5-year policy return was 8.6%, 0.7% higher than your adjusted 5-year policy return of 7.9%. Mirroring this, without adjustment your 5-year total fund implementation impact would be 0.7% lower. Refer to the Research section pages 6-7 for details.

Differences in policy returns and implementation impacts are caused by differences in benchmarks and policy mix.

5-Year returns for frequently used benchmark indices



1. The private equity benchmark returns of all participants were adjusted to reflect investable private equity benchmarks, based on lagged, small-cap stock.

2. The hedge fund benchmark is the average benchmark return reported by U.S. Public participants.

Your 5-year policy return was above the U.S. Public median.

Your 5-year policy return was above the U.S. Public median primarily because of the positive impact of your higher policy weight in:

- U.S. Stock, one of the better performing asset classes of the past 5 years. Your 5-year average policy weight of 36% compares to a U.S. Public average of 24%.
- Private Equity, one of the better performing asset classes of the past 5 years. Your 5-year average policy weight of 12% compares to a U.S. Public average of 8%.

The fact that you had no policy allocation to hedge funds also had a positive impact. The 5-year U.S. Public average allocation to hedge funds was 4%.

5-Year average policy mix

	Your Fund	Peer Avg.	U.S. Public Avg.
U.S. Stock - Broad/All	0%	11%	11%
U.S. Stock - Large Cap	30%	12%	11%
U.S. Stock - Mid Cap	4%	0%	0%
U.S. Stock - Small Cap	2%	2%	2%
EAFE/Global/Emerging	18%	28%	26%
Total Stock	54%	52%	51%
U.S. Bonds	22%	18%	18%
High Yield Bonds	3%	2%	2%
Fixed Income - Emerging	0%	1%	1%
Global Bonds	0%	1%	2%
Other Fixed Income ¹	1%	4%	4%
Total Fixed Income	26%	26%	27%
Hedge Funds	0%	5%	4%
Real Estate incl. REITS	8%	6%	7%
Other Real Assets ²	0%	3%	3%
Private Equity	12%	8%	8%
Total	100%	100%	100%

1. Other fixed income includes Long Bonds and Inflation Indexed bonds.

2. Other Real Assets includes commodities, natural resources and infrastructure.

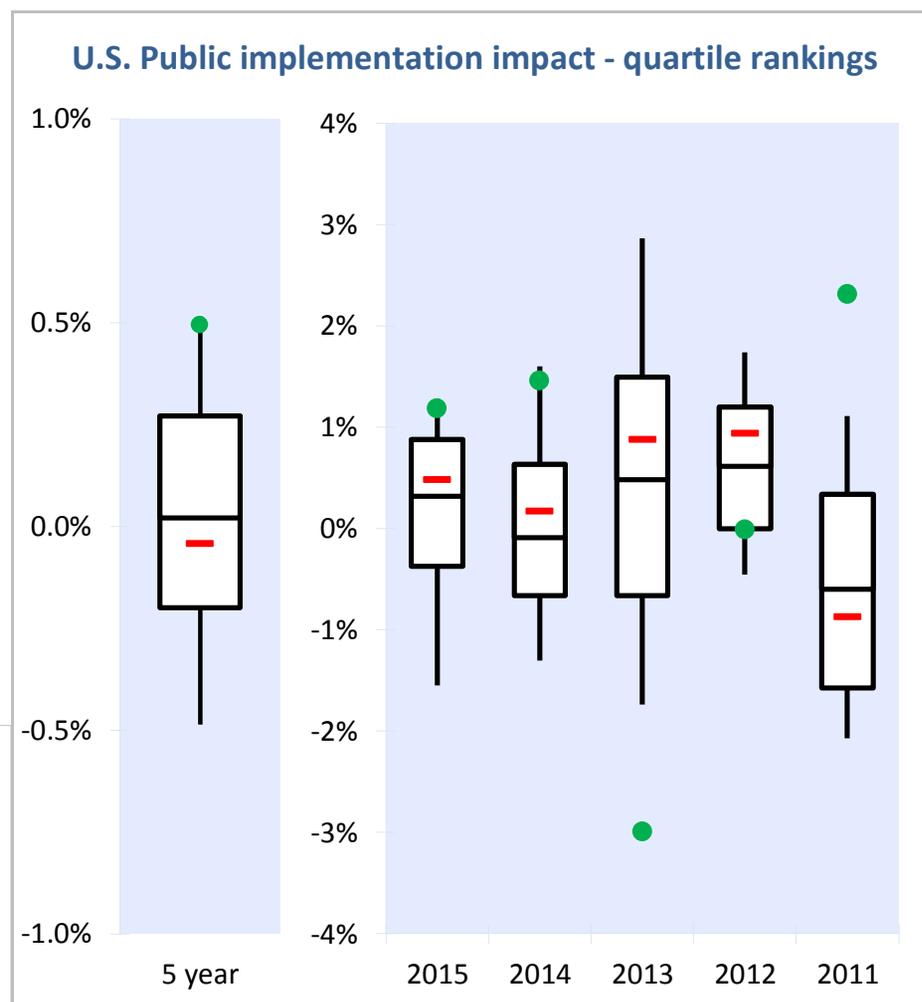
Implementation impact is the difference between total net return and policy return. Your 5-year implementation impact of 0.5% compares to a median of 0.0% for your peers and 0.0% for the U.S. Public universe.

Implementation impact for Montana Board of Investments

Year	Net Return	Policy Return	Impl. Impact
2015	1.9%	0.7%	1.2%
2014	8.0%	6.6%	1.5%
2013	17.4%	20.4%	(3.0%)
2012	13.2%	13.2%	(0.0%)
2011	2.1%	(0.2%)	2.3%
5-year	8.4%	7.9%	0.5%

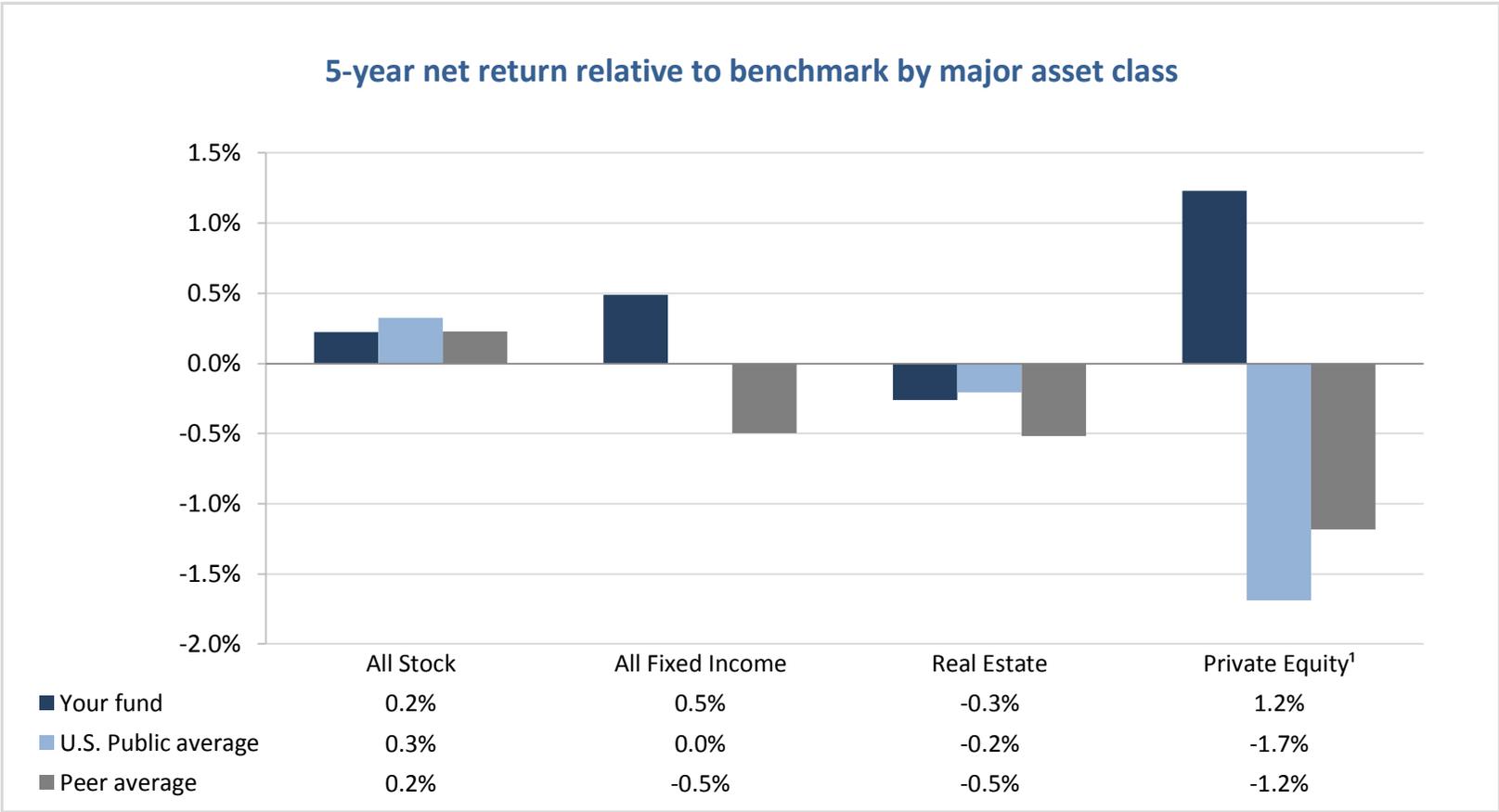
Implementation typically has a modest impact on total fund returns. Implementation impacts are mainly due to:

- Differences in asset class benchmarks across funds.
- Differences between actual holdings and policy weights for asset classes. These differences may be due to tactical asset allocation or rebalancing policies.
- Net return relative to benchmark returns within asset classes.



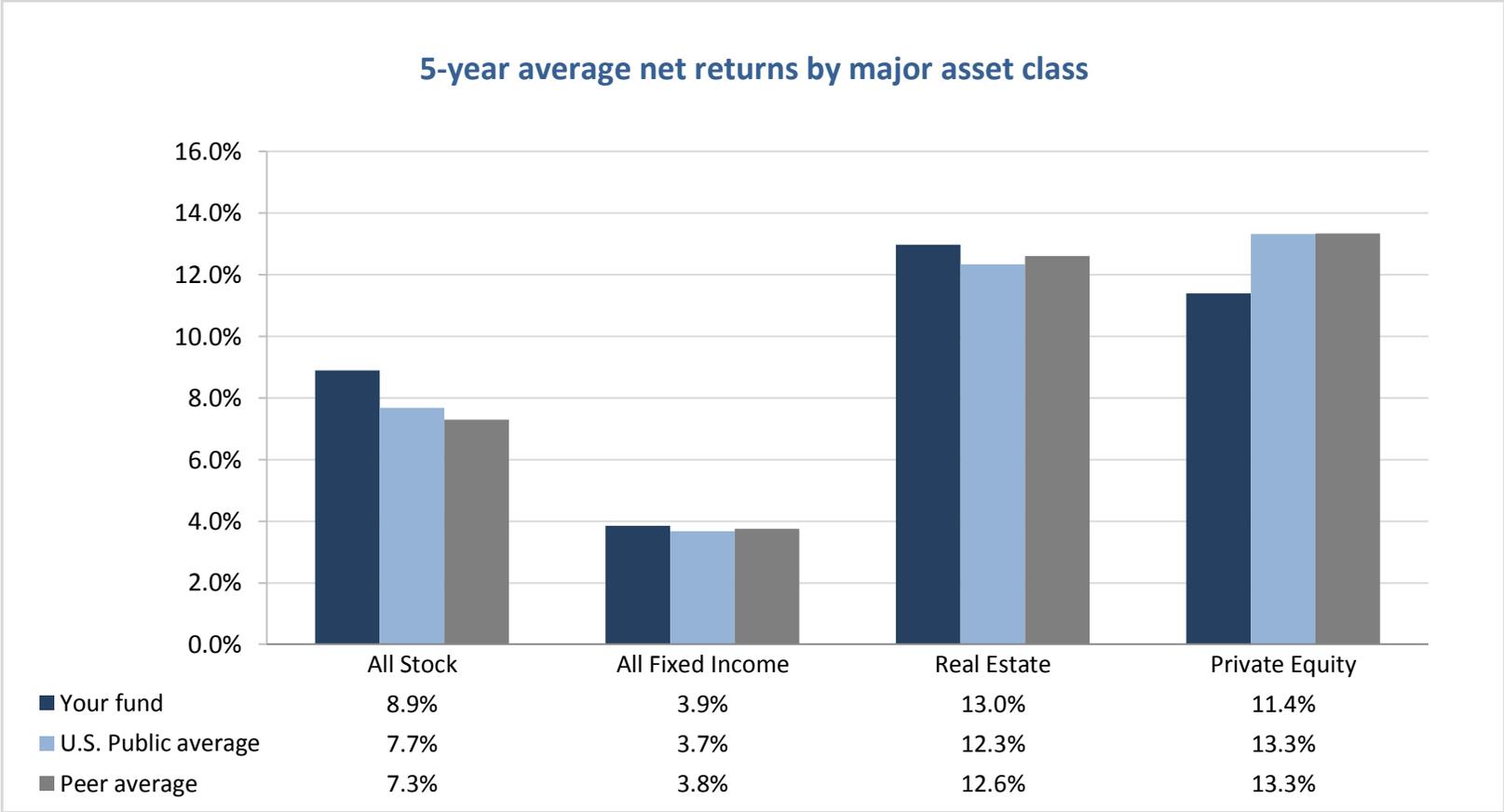
To enable fairer comparisons, the implementation impact for each participant including your fund was adjusted to reflect private equity benchmarks based on investable public market indices. Your custom lag was 0 days. Prior to this adjustment, your fund's 5-year total fund implementation impact was -0.2%. Refer to the Research section, pages 6-7 for details as to why this adjustment may improve comparisons.

Your 5-year total net returns by major asset class compare to your benchmark returns as follows. For the U.S. Public universe, the difference shown is between their average net return and their average benchmark return.



1. To enable fairer comparisons, the private equity benchmarks of all participants, including your fund were adjusted to reflect lagged, investable, public-market indices. Your custom lag was 0 days. Prior to this adjustment, your fund's 5-year private equity net return relative to benchmark was -5.0%. It is also useful to compare total returns. Your 5-year total return of 11.4% for private equity was below the U.S. average of 12.9%.

You had higher 5-year net returns in All Stock, All Fixed Income and Real Estate relative to the U.S. Public average.



The following cost types are included/excluded in the calculation of your total investment cost.

Asset class	Internal		External			
	In-house total cost	Transaction costs	Manager base fees	Monitoring & other costs	Perform. fees (active only)	Transaction costs
<u>Public</u> (Stock, Fixed income, commodities, REITs)	✓	✗	✓	✓	✓	✗
Derivatives/Overlays	✓	✗	✓	✓	✓	✗
<u>Hedge funds & Global TAA</u>						
Hedge Funds	n/a	n/a	✓	✓	✓	✗
Global TAA	✓	✗	✓	✓	✓	✗
<u>Private equity</u> (Diversified private equity, venture capital, LBO, other private equity)	✓	✗	✓*	✓	✗	✗
<u>Private real assets</u> (Infrastructure, natural resources, real estate ex-REITs, other real assets)	✓	✗	✓*	✓	✗	✗

*For limited partnerships, external manager base fees represent gross contractual management fees.

- ✓ indicates cost is included.
- ✗ indicates cost is excluded.
- Green shading indicates that the cost type has been newly added starting data year 2014.
- CEM currently excludes external private asset performance fees and all transaction costs from your total cost because only a limited number of participants are currently able to provide complete data.

Your investment costs were \$56.8 million or 57.5 basis points in 2015.

Asset management costs by asset class and style (\$000s)	Internal Mgmt		External Management			Total
	Active	Overseeing of external	Passive fees	Active base fees	Perform. fees ¹	
U.S. Stock - Large Cap		396	217	4,523		5,137
U.S. Stock - Mid Cap		60	68	2,823		2,950
U.S. Stock - Small Cap		32	8	1,811		1,851
Stock - ACWIxU.S.		388	920	3,107		4,416
Fixed Income - U.S.	410	70		572		1,052
Fixed Income - High Yield		39		838		876
Cash	27					27
Real Estate		159		3,180	47 ¹	3,339
Real Estate - LPs		243		7,746	9,247 ¹	7,989
Diversified Private Equity		568		17,597		18,165
Diversified Priv.Eq. - Fund of Funds		178		8,359		8,537
Total excluding private asset performance fees						54,341 55.0bp
Oversight, custodial and other costs ²						
Oversight of the fund						906
Trustee & custodial						1,188
Consulting and performance measurement						282
Audit						53
Total oversight, custodial & other costs						2,429 2.5bp
Total investment costs (excl. transaction costs & private asset performance fees)						56,769 57.5bp

Footnotes

¹ Total cost excludes carry/performance fees for real estate, infrastructure, natural resources and private equity. Performance fees are included for the public market asset classes and hedge funds.

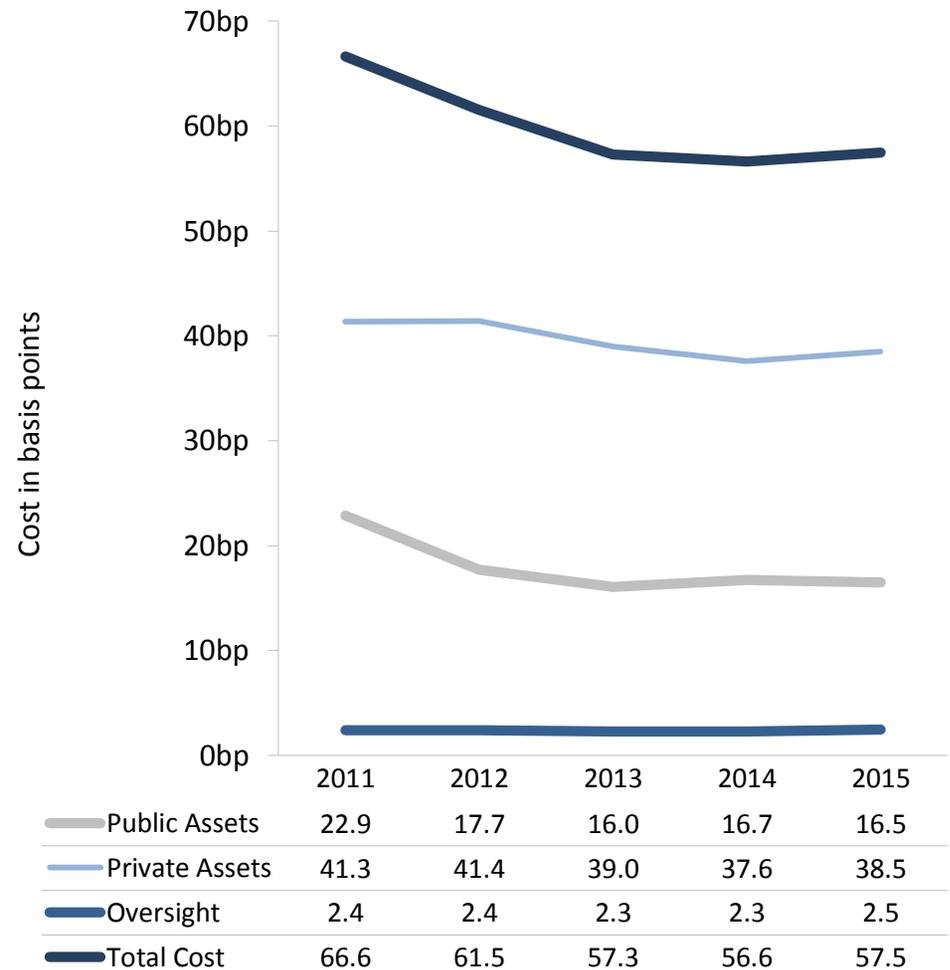
² Excludes non-investment costs, such as PBGC premiums and preparing checks for retirees.

Your costs decreased between 2011 and 2015.

Your costs decreased primarily because:

- You increased your use of lower cost passive and internal management from 37% of assets in 2011 to 54% in 2015.
- You decreased your allocation to higher cost private equity. In 2011 you had 12.6% of your assets invested in Private Equity compared to 10.6% in 2015.

Trend in your investment costs

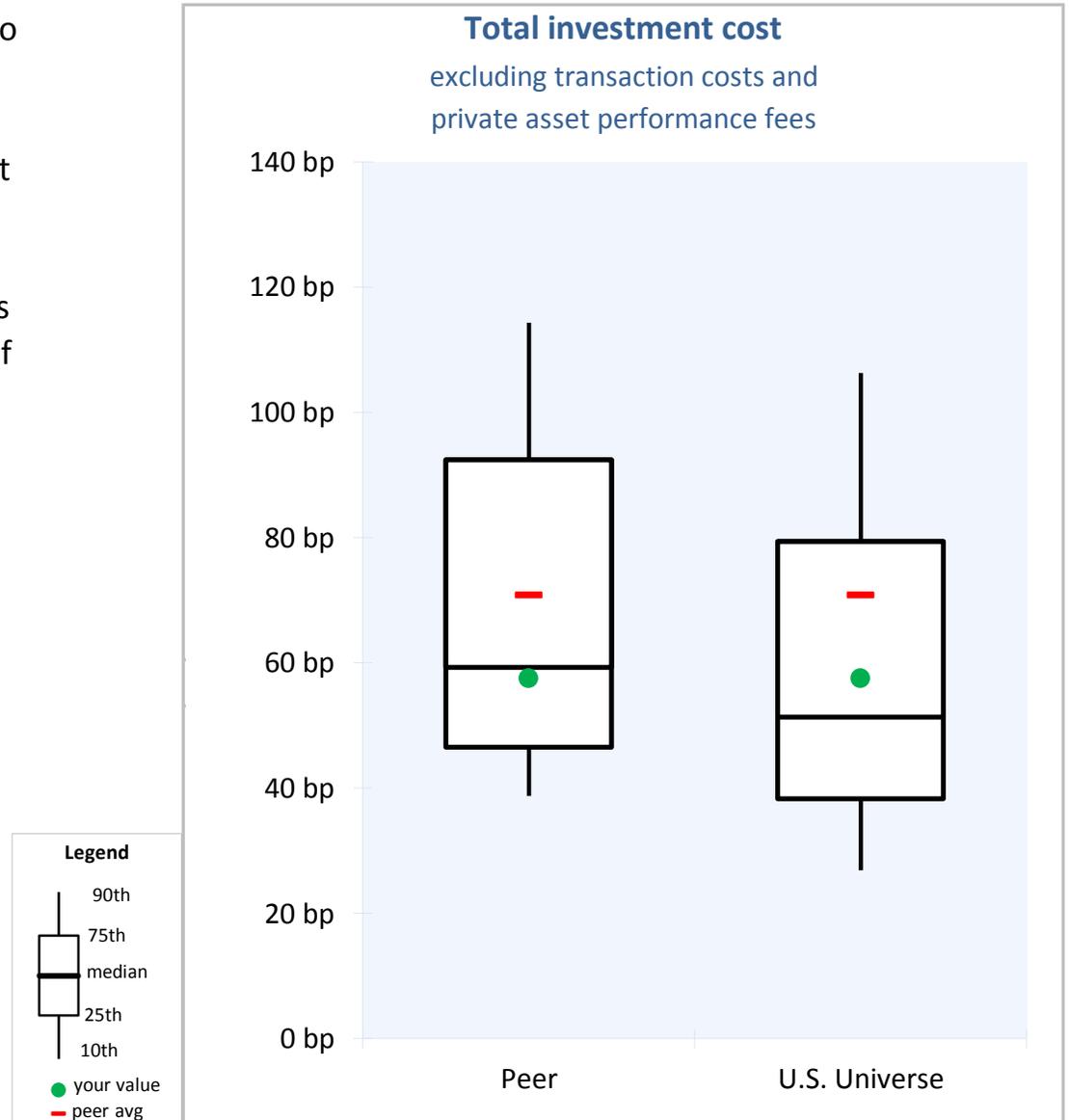


Your total investment cost of 57.5 bps was slightly below the peer median of 59.3 bps.

Differences in total investment cost are caused by two factors that are outside of management's control:

- Asset mix, particularly holdings of the highest cost asset classes: real estate (excl REITS), infrastructure, hedge funds and private equity. These high cost assets equaled 19% of your fund's assets at the end of 2015 versus a peer average of 22%.
- Fund size. Bigger funds have advantages of scale.

Therefore, to assess whether your costs are high or low given your unique asset mix and size, CEM calculates a benchmark cost for your fund. This analysis is shown on the following page.



Benchmark cost analysis suggests that, after adjusting for fund size and asset mix, your fund was low cost by 6.7 basis points in 2015.

Your benchmark cost is an estimate of what your cost would be given your actual asset mix and the median costs that your peers pay for similar services. It represents the cost your peers would incur if they had your actual asset mix.

Your total cost of 57.5 bp was below your benchmark cost of 64.1 bp. Thus, your cost savings was 6.7 bp.

Your cost versus benchmark

	\$000s	basis points
Your total investment cost	56,769	57.5 bp
Your benchmark cost	63,344	64.1 bp
Your excess cost	(6,574)	(6.7) bp

Your fund was low cost because you had a lower cost implementation style and you paid less than peers for similar services.

Reasons for your low cost status

	Excess Cost/ (Savings)	
	\$000s	bps
1. Lower cost implementation style		
• Less fund of funds	(1,282)	(1.3)
• Less external active management (more lower cost passive and internal)	(2,645)	(2.7)
• Less overlays	(656)	(0.7)
• Other style differences	(10)	(0.0)
	<u>(4,594)</u>	<u>(4.7)</u>
2. Paying less than peers for similar services		
• External investment management costs	(866)	(0.9)
• Internal investment management costs	(0)	(0.0)
• Oversight, custodial & other costs	(1,115)	(1.1)
	<u>(1,981)</u>	<u>(2.0)</u>
Total savings	(6,574)	(6.7)

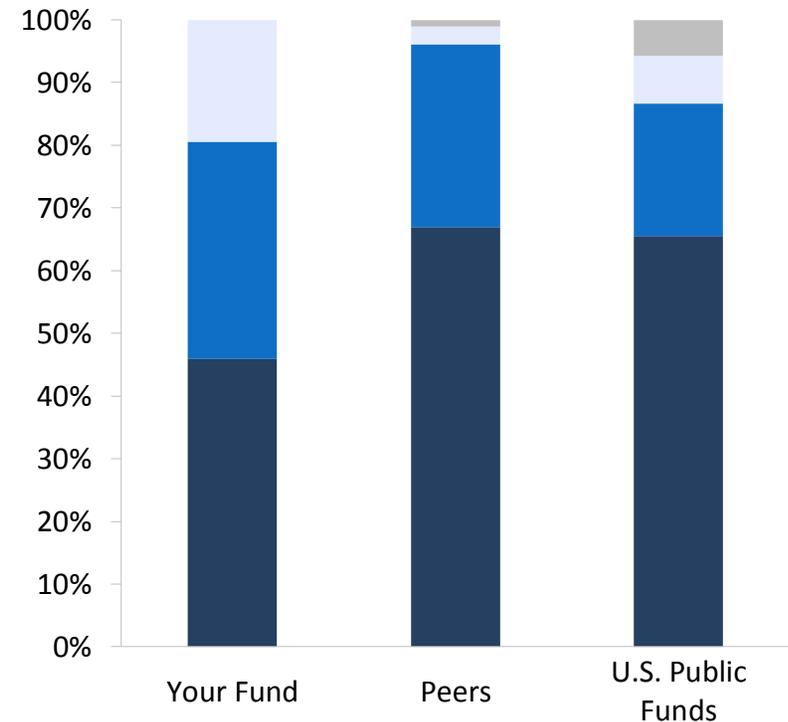
Differences in cost performance are often caused by differences in implementation style.

Implementation style is defined as the way in which your fund implements asset allocation. It includes internal, external, active, passive and fund of funds styles.

The greatest cost impact is usually caused by differences in the use of:

- External active management because it tends to be much more expensive than internal or passive management. You used less external active management than your peers (your 46% versus 67% for your peers).

Implementation style¹



■ Internal passive	0%	1%	6%
■ Internal active	19%	3%	8%
■ External passive	35%	29%	21%
■ External active	46%	67%	65%

1. The graph above does not take into consideration the impact of derivatives.

Differences in implementation style saved you 4.7 bp relative to your peers.

Calculation of the cost impact of differences in implementation style

Asset class	Your avg holdings in \$mils (A)	% External active			Premium vs passive & internal ¹ (C)	Cost/ (savings) \$000s bps (A X B X C)	
		You	Peer average	More/ (less) (B)			
U.S. Stock - Large Cap	3,219	29.7%	32.2%	(2.5%)	31.5 bp	(254)	
U.S. Stock - Mid Cap	488	83.8%	91.2%	(7.4%)	52.5 bp	(190)	
U.S. Stock - Small Cap	262	97.6%	88.8%	8.9%	64.6 bp	150	
Stock - ACWIxU.S.	1,613	33.4%	49.0%	(15.6%)	47.5 bp	(1,196)	
Fixed Income - U.S.	2,073	14.6%	63.4%	(48.8%)	16.1 bp	(1,631)	
Fixed Income - High Yield	167	100.0%	81.5%	18.5%	Insufficient ²	0	
Real Estate ex-REITs	1,055	100.0%	100.0%	(0.0%)		0	
Partnerships, as a proportion of external:	1,055	67.8%	54.8%	13.0%	34.8 bp	476	
Diversified Private Equity	1,647	100.0%	100.0%	0.0%		0	
Impact of less/more external active vs. lower cost styles						(2,645)	(2.7) bp
		<u>Fund of funds % of LPs</u>			<u>Premium vs. direct LP¹</u>		
Real Estate ex-REITs - LPs	716	0.0%	1.6%	(1.6%)	Insufficient ²	0	
Diversified Private Equity - LPs	1,647	27.5%	36.2%	(8.7%)	89.5 bp	(1,282)	
Impact of less/more fund of funds vs. direct LPs						(1,282)	(1.3) bp
<u>Overlays and other</u>							
Impact of lower use of portfolio level overlays						(656)	(0.7) bp
Impact of mix of internal passive, internal active, and external passive ³						(10)	(0.0) bp
Total impact of differences in implementation style						(4,594)	(4.7) bp

1. The cost premium is the additional cost of external active management relative to the average of other lower cost implementation styles - internal passive, internal active and external passive.

2. A cost premium listed as 'Insufficient' indicates that there was not enough peer data to calculate the premium.

3. The 'Impact of mix of internal passive, internal active and external passive' quantifies the net cost impact of differences in cost between, and your relative use of, these 'low-cost' styles.

The net impact of paying more/less for external asset management costs saved 0.9 bps.

Cost impact of paying more/(less) for external asset management

	Your avg holdings in \$mils (A)	Cost in bps			Cost/ (savings) in \$000s (A x B)
		Your Fund	Peer median	More/ (less) (B)	
U.S. Stock - Large Cap - Passive	2,264	1.0	1.3	(0.3)	(76)
U.S. Stock - Large Cap - Active	955	51.5	32.8	18.7	1,790
U.S. Stock - Mid Cap - Passive	79	8.6	3.6*	4.9	39
U.S. Stock - Mid Cap - Active	409	70.5	56.1	14.4	587
U.S. Stock - Small Cap - Passive	6	13.0	3.9	9.1	6
U.S. Stock - Small Cap - Active	256	72.0	68.5	3.5	90
Stock - ACWIxU.S. - Passive	1,074	8.6	6.0	2.5	272
Stock - ACWIxU.S. - Active	539	64.8	53.5	11.3	609
Fixed Income - U.S. - Active	303	21.2	18.5	2.7	81
Fixed Income - High Yield - Active	167	52.3	49.6	2.7	45
Real Estate ex-REITs - Active	340	98.2	90.8	7.4	252
Real Estate ex-REITs - Limited Partnership	716	111.6	125.7	(14.0)	(1,004)
Diversified Private Equity - Active	1,194	152.2	169.1	(16.9)	(2,018)
Diversified Private Equity - Fund of Fund	453	55.5 ¹	89.5	(34.0)	(1,540)
Total impact of paying more/less for external management					(866)
Total in bps					(0.9) bp

*Universe median used as peer data was insufficient.

¹ The cost comparison for fund of funds private equity is only based on top-layer fees. The underlying fees were excluded because we could not confirm they were gross partnership costs.

The net impact of paying more/less for internal asset management costs rounds to 0.0 bps.

Cost impact of paying more/(less) for internal asset management

	Your avg holdings in \$mils (A)	Cost in bps			Cost/ (savings) in \$000s (A X B)
		Your Fund	Peer median	More/ (less) (B)	
Fixed Income - U.S. - Active	1,770	2.3	2.3*	(0.0)	(0)
Total impact of paying more/less for internal management					(0)
Total in bps					(0.0) bp

*Universe median used as peer data was insufficient.

The net impact of differences in oversight, custodial & other costs saved 1.1 bps.

Cost impact of differences in oversight, custodial & other costs

	Your avg holdings in \$mils (A)	Cost in bps			Cost/ (savings) in \$000s (A X B)
		Your fund	Peer median	More/ (less) (B)	
Oversight	9,878	0.9	1.4	(0.5)	(462)
Consulting	9,878	0.3	0.8	(0.6)	(546)
Custodial ¹	9,878	1.2	0.6	0.6	564
Audit	9,878	0.1	0.1	(0.1)	(67)
Other ²	9,878	0.0	0.6	(0.6)	(605)
Total					(1,115)
Total in bps					(1.1) bp

1. Important additional information about your custodial fees relative to peers:

- a. The peer median of 0.6 bps is unusually low. The U.S. universe median custodial cost was 0.9 bps. (See page 3 in Section 6).
- b. You have a more complex structure than your peers. You have 9 plans on your platform, most peers have less than 2 plans.
- c. Specific services provided by custodians for funds vary somewhat. CEM does not collect detailed data related to specific custodial arrangements.

2. 'Other' typically includes legal fees and fiduciary manager fees that apply to the plan as a whole and cannot be allocated to the asset classes.

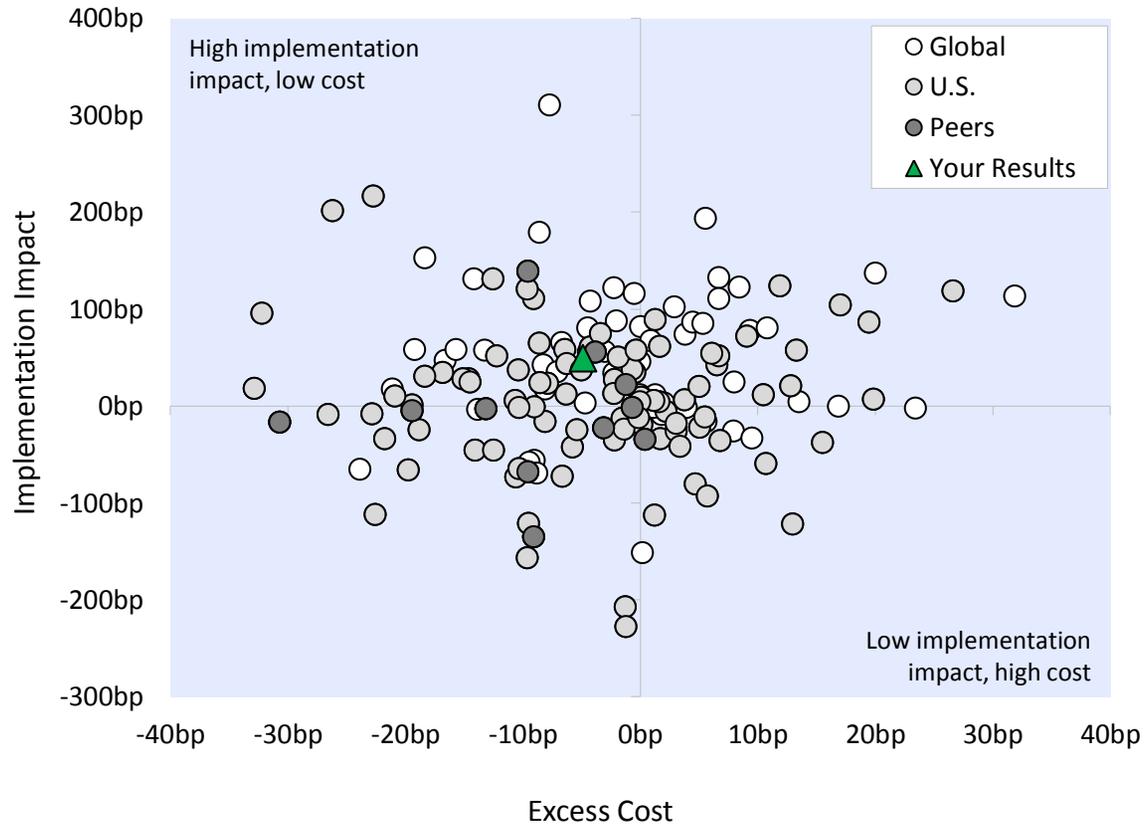
In summary, your fund was low cost because you had a lower cost implementation style and you paid less than peers for similar services.

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	<u>(1,981)</u>	<u>(2.0)</u>
Total savings	<u>(6,574)</u>	<u>(6.7)</u>

Your fund achieved 5-year implementation impact of 49 bps and cost savings of 5 bps on the cost effectiveness chart.

5-year implementation impact versus excess cost
(Your 5-year: implementation impact 49 bps, cost savings 5 bps)



Summary of key takeaways

Returns

- Your 5-year net total return was 8.4%. This was above the U.S. Public median of 7.2% and above the peer median of 7.2%.
- Your 5-year policy return was 7.9%. This was above the U.S. Public median of 7.3% and above the peer median of 7.2%.

Implementation impact

- Your 5-year implementation impact was 0.5%. This was above the U.S. Public median of 0.0% and above the peer median of 0.0%.

Cost and cost effectiveness

- Your investment cost of 57.5 bps was below your benchmark cost of 64.1 bps. This suggests that your fund was low cost compared to your peers.
- Your fund was low cost because you had a lower cost implementation style and you paid less than peers for similar services.
- Your fund achieved 5-year implementation impact of 49 bps and cost savings of 5 bps on the cost effectiveness chart.

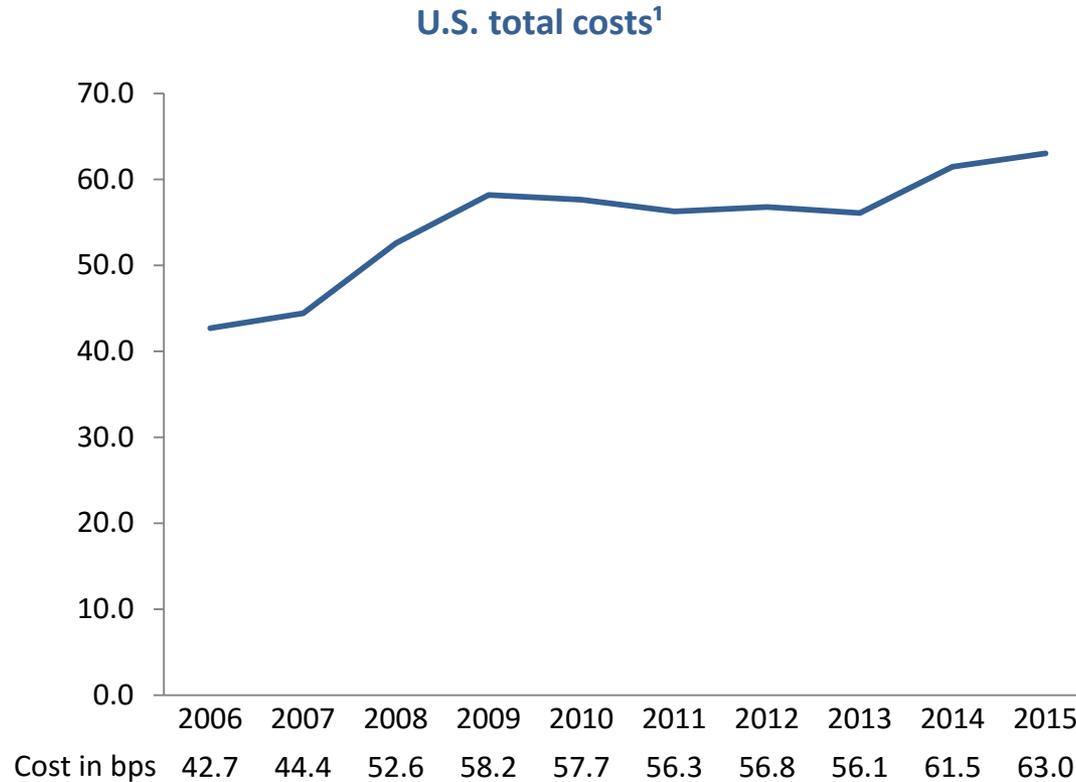
Key Trends and Research Insights from the CEM Investment Database



Mike Heale, Principal
mike@cembenchmarking.com
416 369-0468

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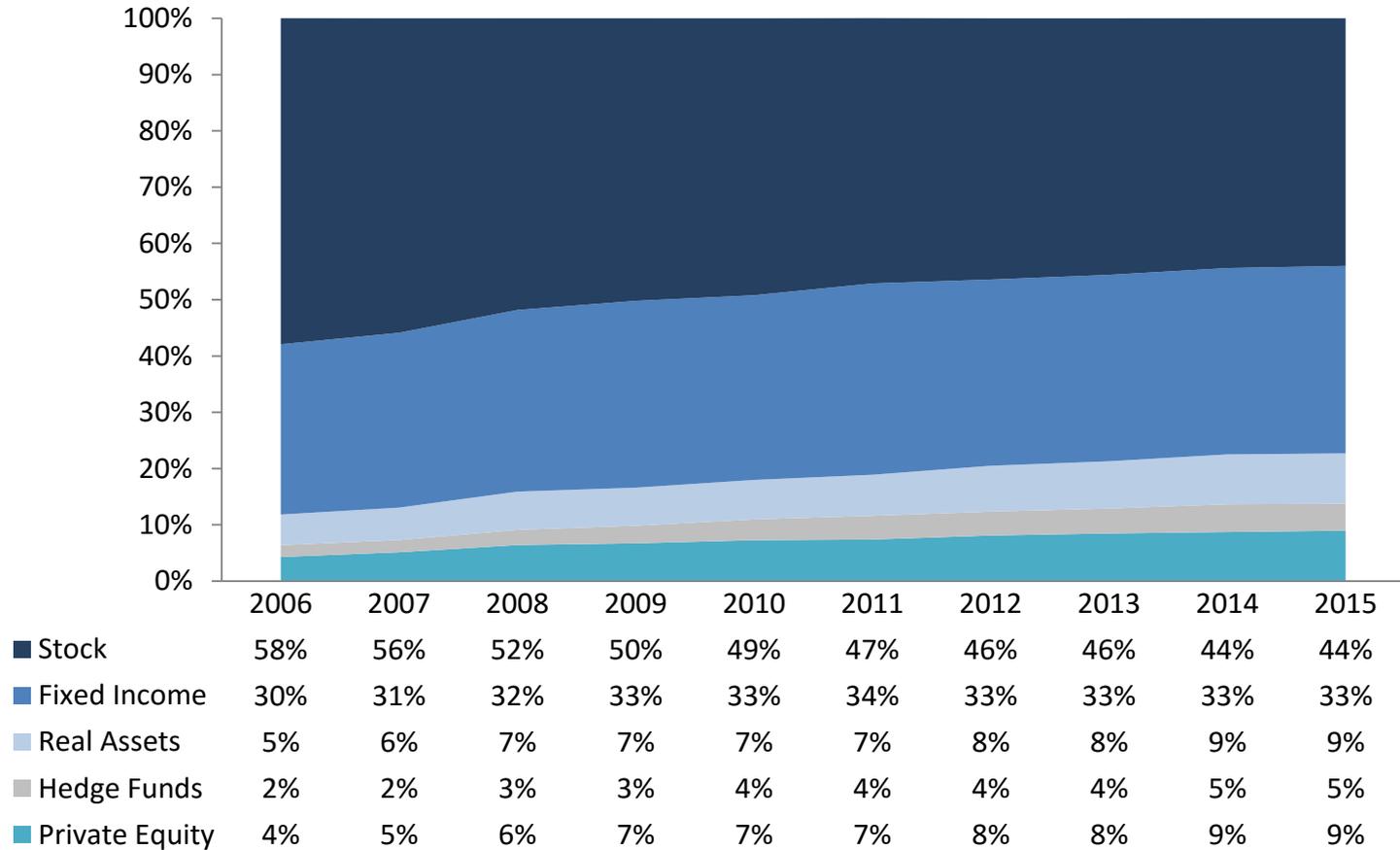
U.S. fund costs have grown by 21 bps on average over the past 10 years.



1. This analysis is based on 62 U.S. funds with 10 consecutive years of data.

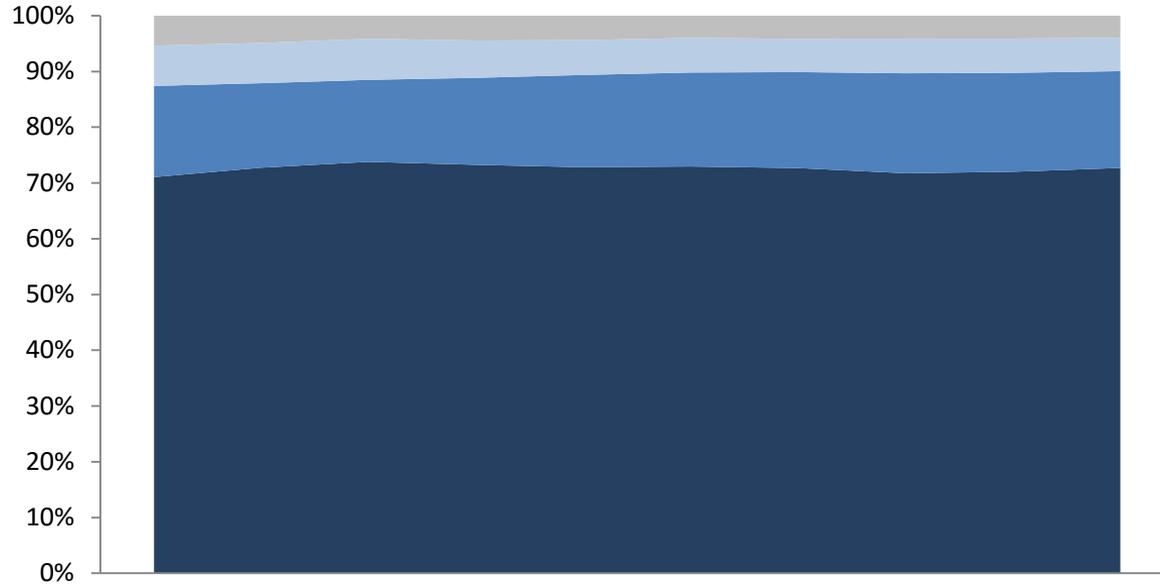
Combined policy weights for real assets, hedge funds, and private equity increased from 11.8% to 22.7% over the past 10 years.

Policy mix by year - U.S.



External active management increased from 71% to 73% over the past 10 years.

Implementation style by year - U.S.



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
■ % Internal passive	5%	5%	4%	4%	4%	4%	4%	4%	4%	4%
■ % Internal active	7%	7%	7%	7%	6%	6%	6%	6%	6%	6%
■ % External passive	16%	15%	15%	16%	17%	17%	17%	18%	18%	17%
■ % External active	71%	73%	74%	73%	73%	73%	73%	72%	72%	73%

Key U.S. pension fund long-term performance results.

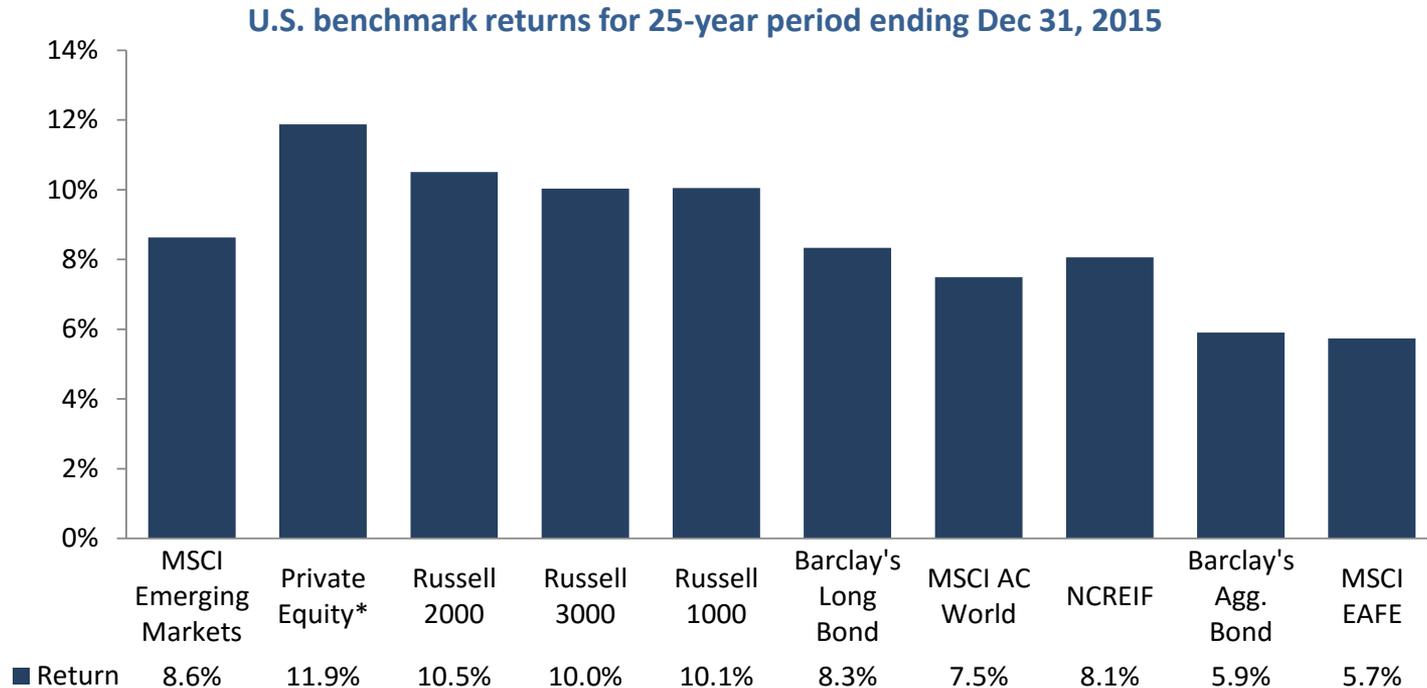
U.S. Pension Fund Universe 25 - year annual average performance	
Total Return	9.55%
Less Policy Return	8.89%
= Gross Value Added	0.66%
Less Costs	0.47%
= Net Value Added	0.19%

Asset mix is by far the most important driver of total returns.

Costs consumed more than 70% of gross value added.

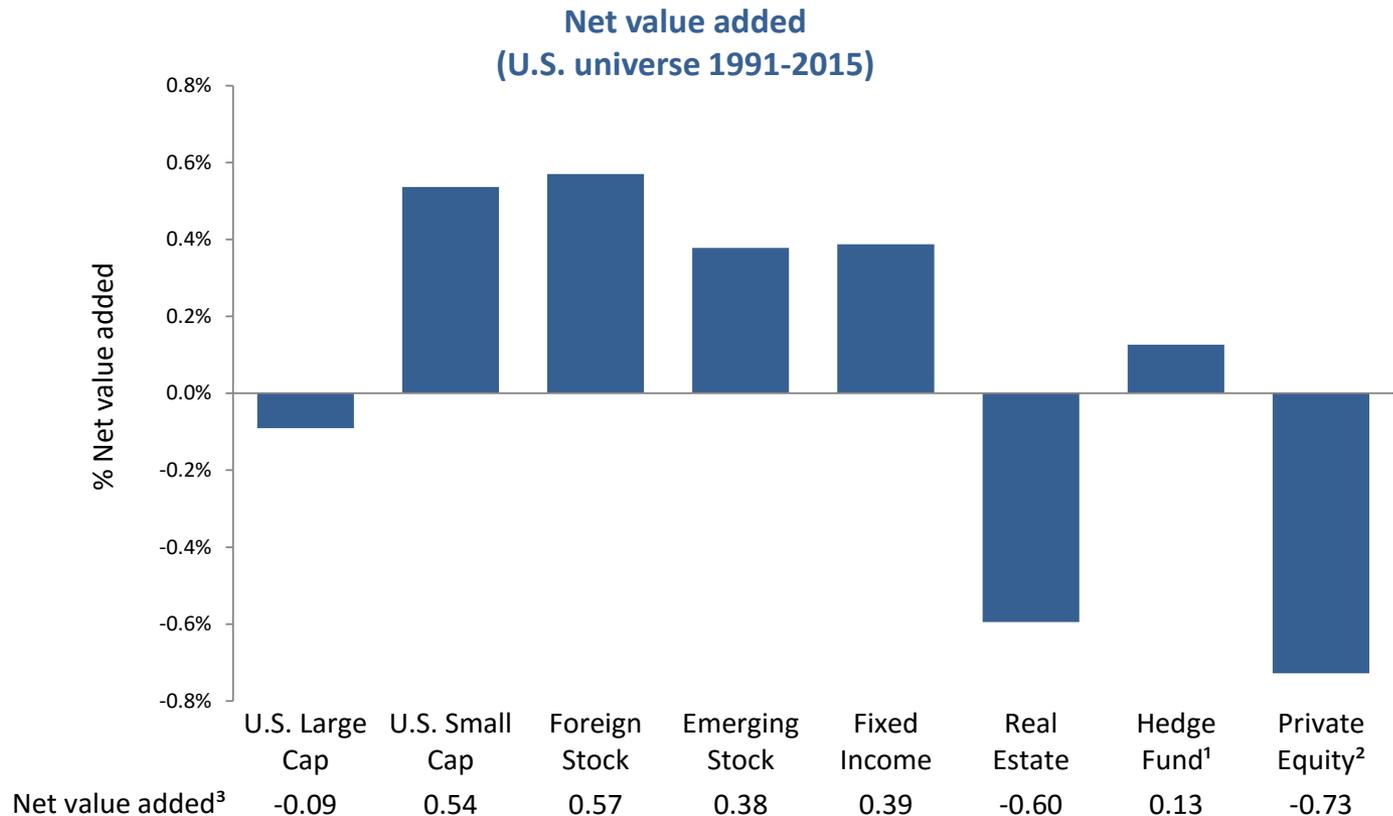
Active management has added modest value added, net of costs.

U.S. pension fund long-term benchmark returns by major asset class:



* The benchmark for Private Equity is the compound average return of annual average benchmarks used by all participants.

Net value added from active management by major asset class for U.S. funds over the past 25 years:



1. Hedge Fund gross value added performance reflect data for the 16 year period from 2000 to 2015.

2. The net value added calculation for private equity uses the average benchmark of all U.S. participants.

3. Value added analysis is from 4,194 annual fund performance observations from the CEM U.S. universe for the 25-year period ending 2015. Value added reflects the asset weighted value added of all mandates in each asset category including indexed holdings. Averages shown above are the arithmetic average of the annual averages of all observations of funds with holdings in the asset category for each year.

U.S. fund characteristics associated with higher net value added from active management:

Summary of findings (1991-2015)

Fund characteristic	Impact on net value added
Fund size	Larger funds performed better than smaller funds.
Asset mix	Larger holdings in the following asset classes helped performance: U.S. Small Cap stock and Private Equity.
Implementation style	Funds with more internal management performed better than those with less internal management.
Number of external managers	No impact.
Total cost	Funds with lower total cost performed better than those with higher total cost.
Fund type (i.e., Corporate, Public)	No impact.