Pennsylvania Public School Employees' Retirement System

Investment Review – For Period Ending December 31, 2006
Asset / Liability Analysis
Independent Fiduciary Services, Inc. (IFS) Recommendations

William G. Bensur, Jr., CFA
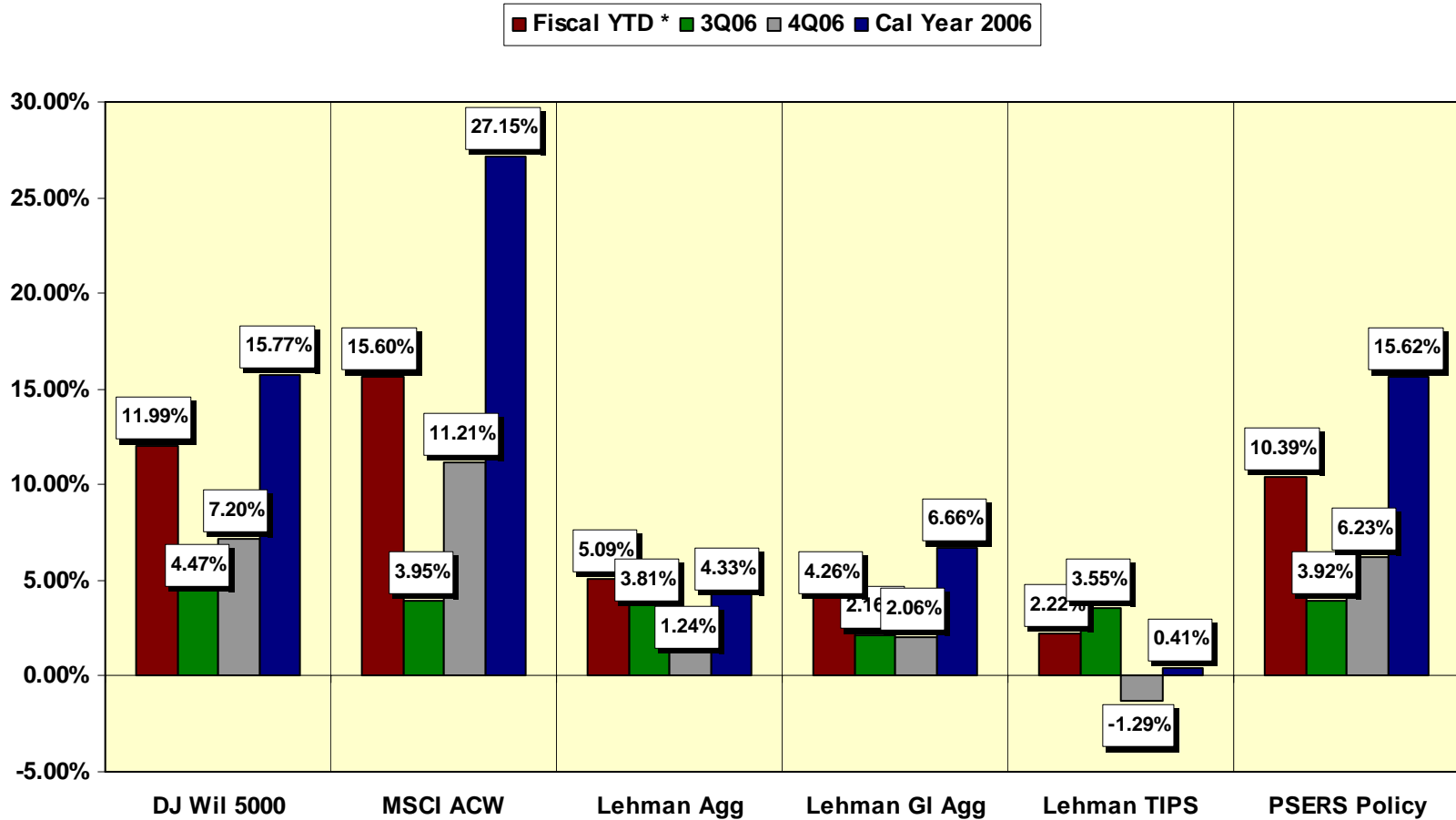Managing Director

March 15, 2007

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Investment Review
As of December 31, 2006

Capital Market Update

Benchmark Performance
2006
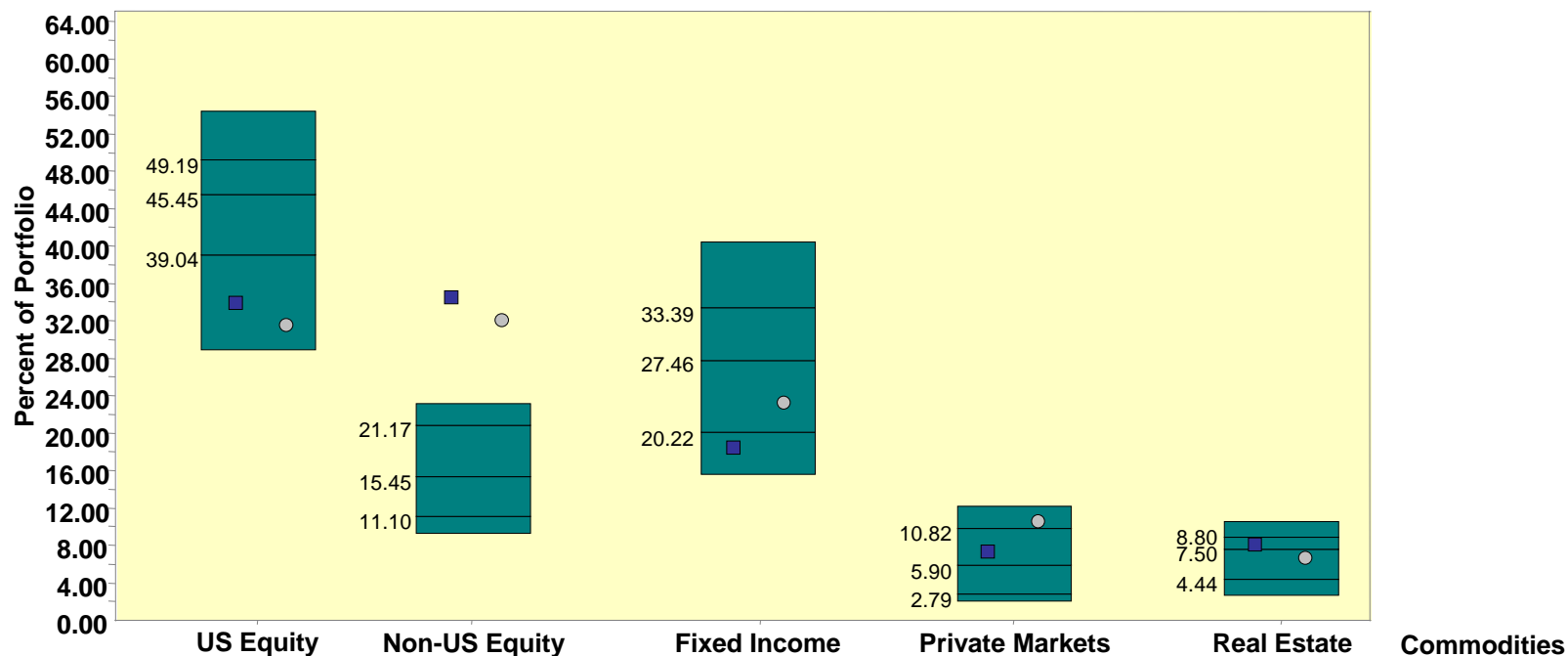

* June 30, 2006 Through December 31, 2006

Asset Allocation – Total Fund *

PSERS vs All Public Funds
As of December 31, 2006

	US Equity	Non-US Equity	Fixed Income	Private Markets	Real Estate	Commodities
■ All Assets	31.78 (82)	33.65 (1)	18.79 (78)	8.67 (33)	7.27 (53)	1.00 (--)
○ Policy ^	29.50 (89)	29.50 (2)	22.00 (69)	11.00 (17)	7.00 (61)	1.00 (--)
Number of Funds	46	44	45	26	38	--

* As Allocated
^ US Equity and Non-US Equity Policy Targets Will Reduce to 27.5% as Commodities are Funded

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Asset Allocation – Total Fund *

PSERS vs Large Public Funds **
As of December 31, 2006

|	US Equity ^	Non-US Equity	Fixed Income	Alternative Investments	Real Estate	Commodities
Large Public Funds						
PSERS Total Fund Composite	**31.78%**	**33.65%**	**18.79%**	**8.67%**	**7.27%**	**1.00%**
Policy ^^	29.50%	29.50%	22.00%	11.00%	7.00%	1.00%
Variance	**+2.28%**	**+4.15%**	**-3.21%**	**-2.33%**	**+0.27%**	**0.00%**
Large Public Fund A	49.96%	16.64%	22.77%	5.90%	1.77%	--
Large Public Fund B	37.38%	21.69%	22.82%	7.63%	7.50%	--
Large Public Fund C	50.59%	15.77%	20.09%	3.02%	5.29%	--
Large Public Fund D	29.91%	15.13%	38.41%	7.80%	9.16%	--
Large Public Fund E	49.00%	12.40%	15.90%	12.50%	7.10%	--
Large Public Fund F	49.20%	12.30%	15.70%	11.70%	8.10%	--
Large Public Fund G	45.36%	22.16%	17.21%	10.84%	2.24%	--
Large Public Fund H	33.70%	23.30%	26.50%	5.90%	9.40%	--
Large Public Fund I	24.79%	23.84%	23.29%	16.92%	10.54%	--

* As Allocated
** Over $10 Billion
^^ US Equity and Non-US Equity Policy Targets Will Reduce to 27.5% as Commodities are Funded

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Performance Comparison – Total Fund *

PSERS vs All Public Funds
For Periods Ending December 31, 2006
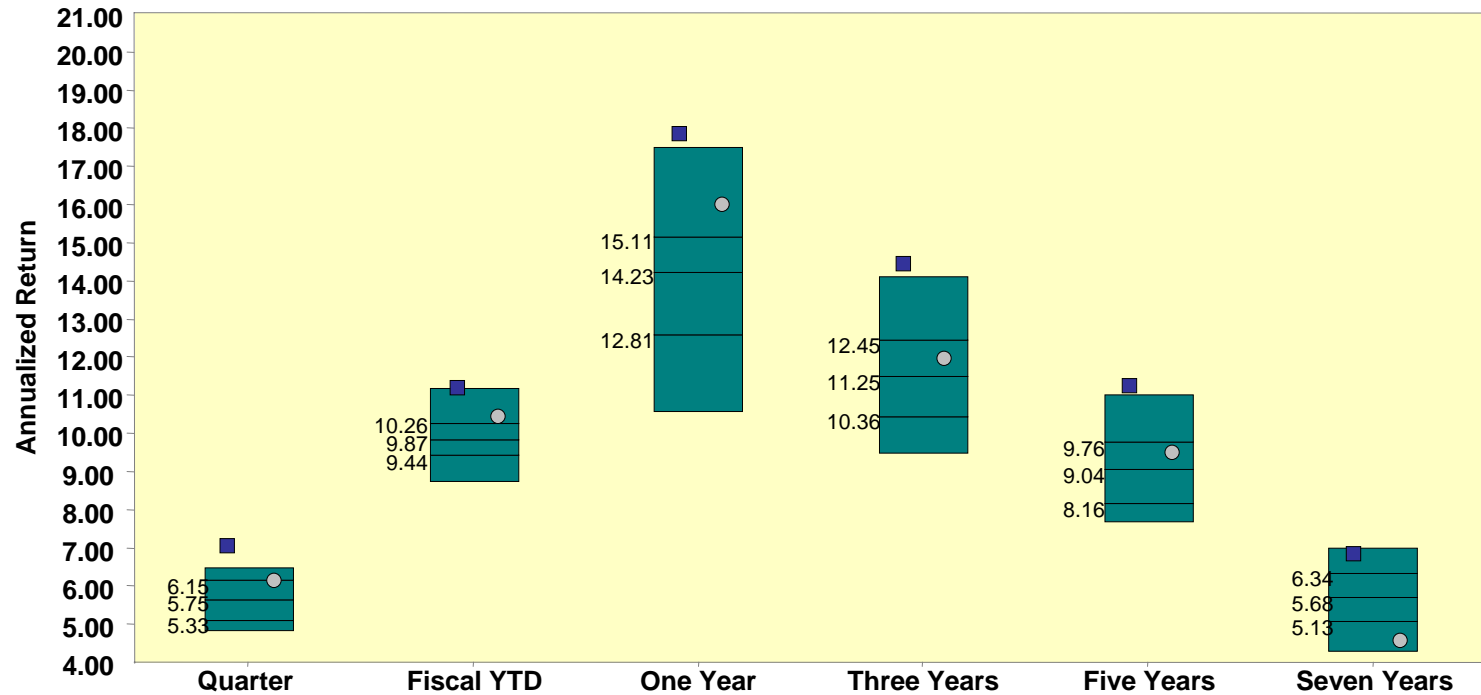
	Quarter	Fiscal YTD	One Year	Three Years	Five Years	Seven Years
■ Total Fund	6.90 (2)	11.21 (8)	18.04 (4)	14.77 (5)	11.48 (2)	6.81 (16)
○ Policy ^	6.23 (23)	10.39 (22)	15.62 (17)	12.18 (33)	9.57 (34	4.94 (84)
Number of Funds	46	46	46	39	37	36

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Performance Comparison – Total Fund *

PSERS vs Large Public Funds ^
For Periods Ending December 31, 2006

	Quarter	Fiscal YTD	One Year	Three Years	Five Years	Seven Years
Large Public Funds						
PSERS Total Fund Composite	**6.90%**	**11.21%**	**18.04%**	**14.77%**	**11.48%**	**6.81%**
Policy Index ^^	6.23%	10.39%	15.62%	12.18%	9.57%	4.94%
Variance	**+0.67%**	**+0.82%**	**+2.42%**	**+2.59%**	**+1.91%**	**+1.87%**
Large Public Fund A	5.78%	9.98%	14.60%	12.30%	9.03%	5.00%
Large Public Fund B	5.95%	10.76%	15.41%	12.98%	9.96%	5.87%
Large Public Fund C	6.04%	10.10%	14.45%	11.31%	8.01%	4.20%
Large Public Fund D	5.43%	9.40%	13.73%	11.68%	9.57%	6.18%
Large Public Fund E	4.98%	9.75%	15.03%	11.70%	8.16%	5.37%
Large Public Fund F	4.99%	9.70%	15.03%	11.68%	8.16%	5.36%
Large Public Fund G	5.33%	7.84%	14.23%	12.64%	9.59%	5.82%
Large Public Fund H	5.55%	10.77%	15.87%	12.45%	9.79%	6.21%
Large Public Fund I	5.75%	10.11%	17.90%	14.85%	10.85%	6.39%

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Total Fund Attribution *

Quarter Ending December 31, 2006
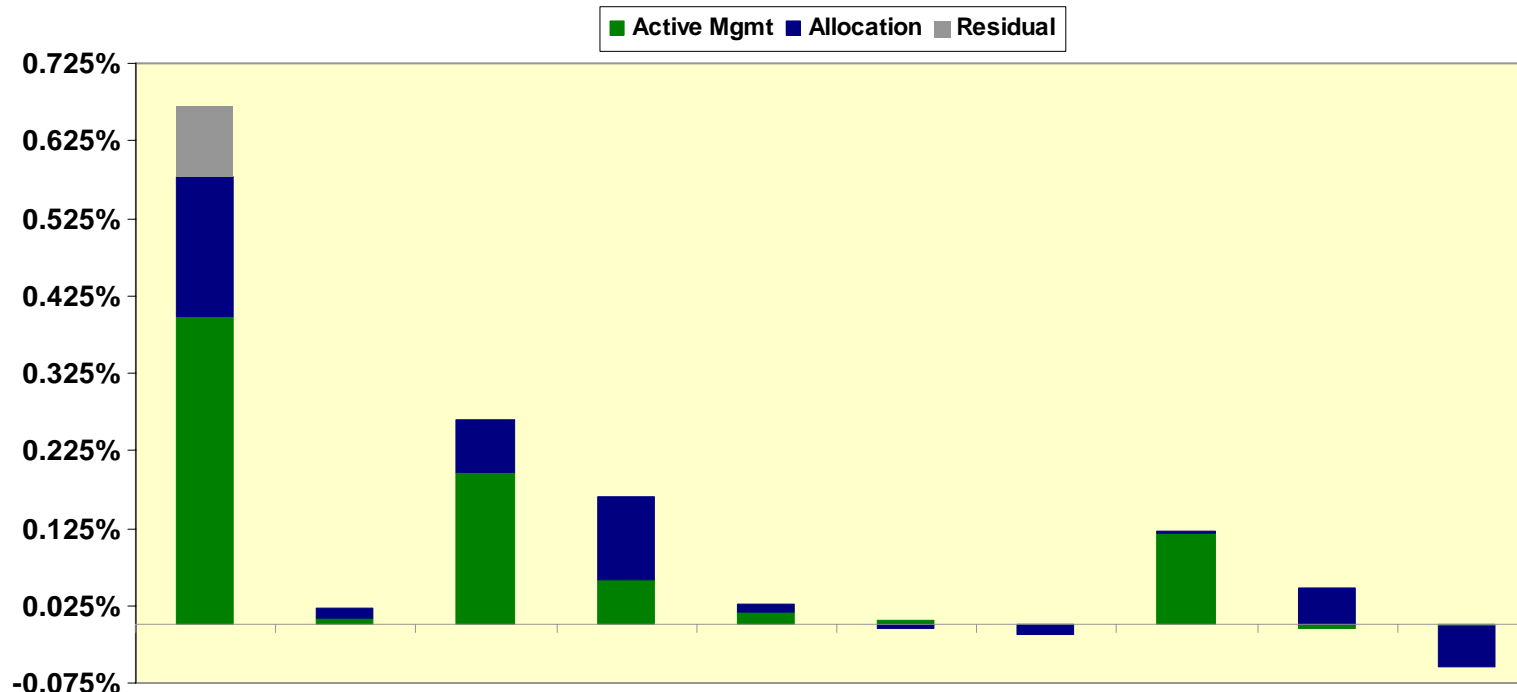
	Total	US Equity	Non-US Equity	Fixed x TIPS	TIPS	Global Fixed	REIT	Private RE	Alternatives	Cash
Total	**0.670%**	**0.022%**	**0.265%**	**0.166%**	**0.027%**	**0.002%**	**-0.013%**	**0.120%**	**0.044%**	**-0.054%**
Active Management	0.397%	0.009%	0.196%	0.058%	0.016%	0.006%	0.000%	0.118%	-0.005%	-0.001%
Allocation	0.182%	0.013%	0.069%	0.108%	0.011%	-0.004%	-0.013%	0.002%	0.049%	-0.053%
Residual	0.091%									

* Net of Fees

Skill Analysis

Excess Return vs Policy Index *
Five-Year Period Ending December 31, 2006
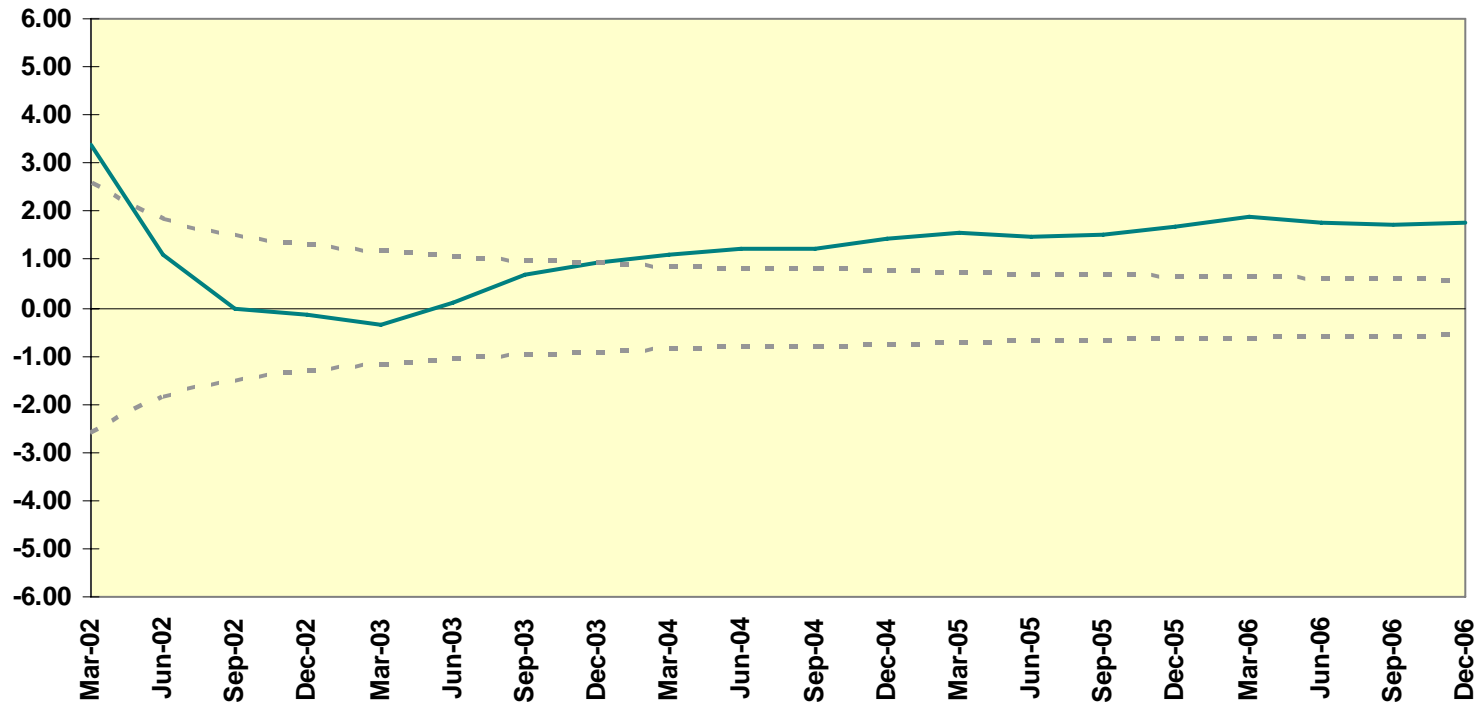
Excess Return:	1.75	Information Ratio:	1.72	N:	0.6
Excess Risk:	1.02	T-Stat:	3.84		

* Net of Fees, Geometric Excess Return Calculation

Skill Analysis

Excess Return vs Policy Index *
Seven-Year Period Ending December 31, 2006
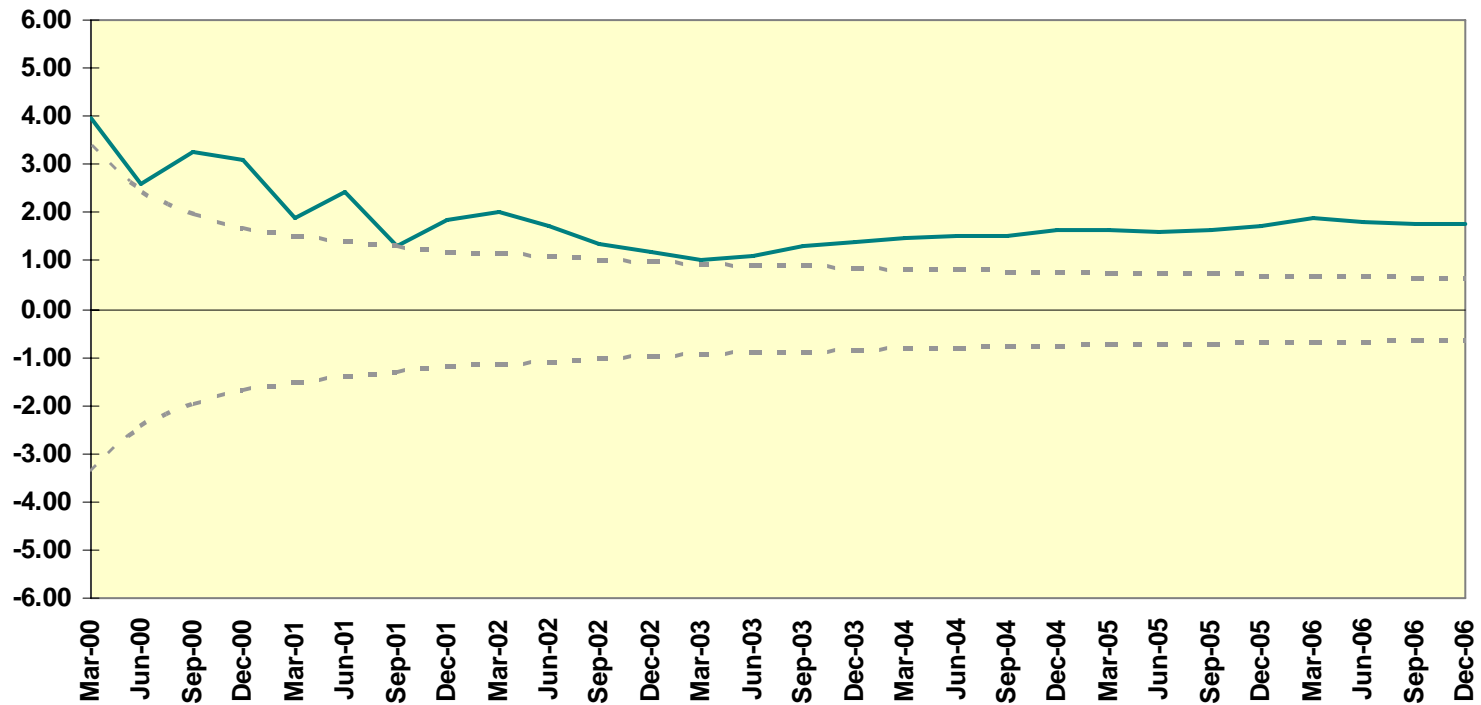
Excess Return:	1.78	Information Ratio:	1.34	N:	0.9
Excess Risk:	1.33	T-Stat:	3.55		

* Net of Fees, Geometric Excess Return Calculation

Risk / Return Analysis

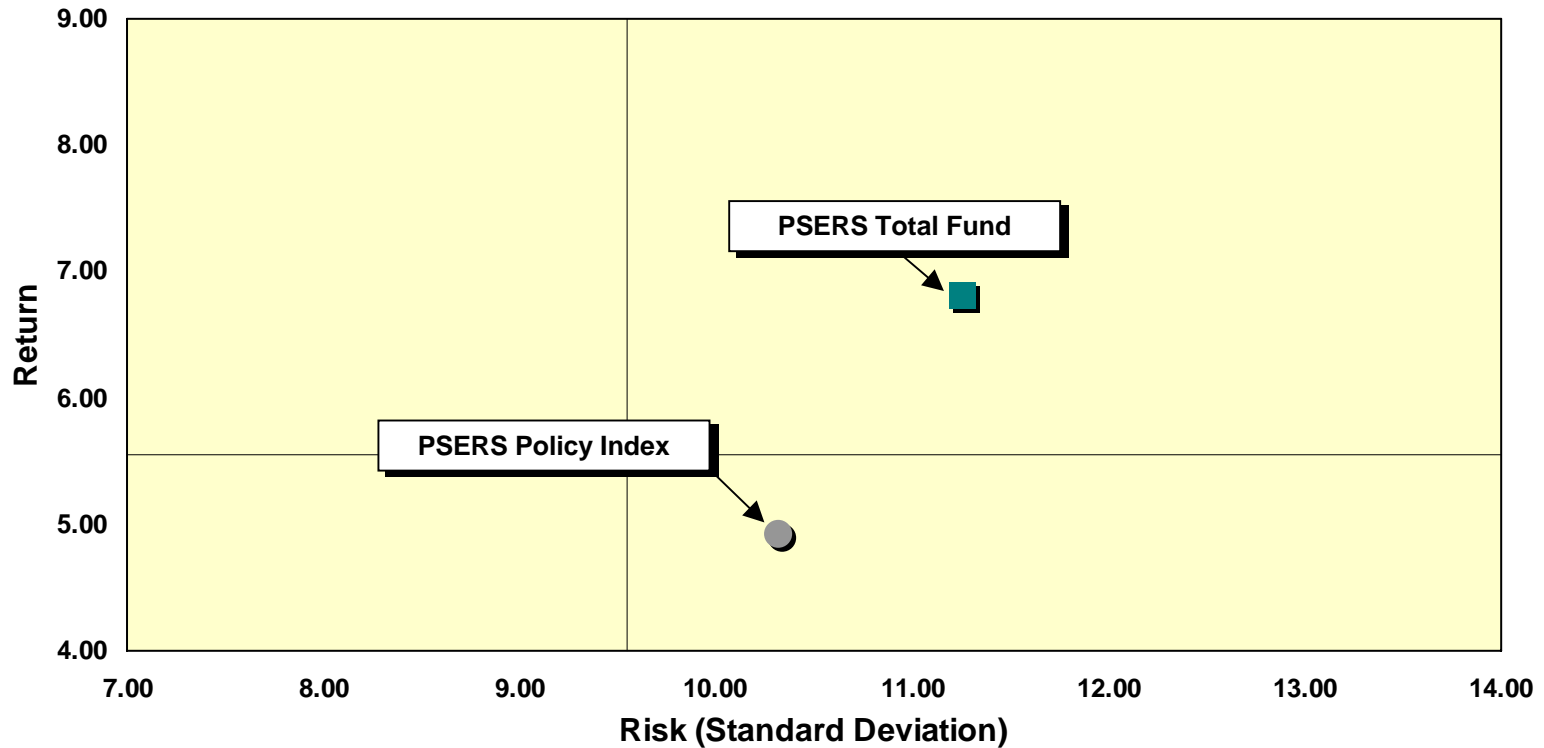## PSERS Total Fund vs All Public Funds *
Five-Year Period Ending December 31, 2006
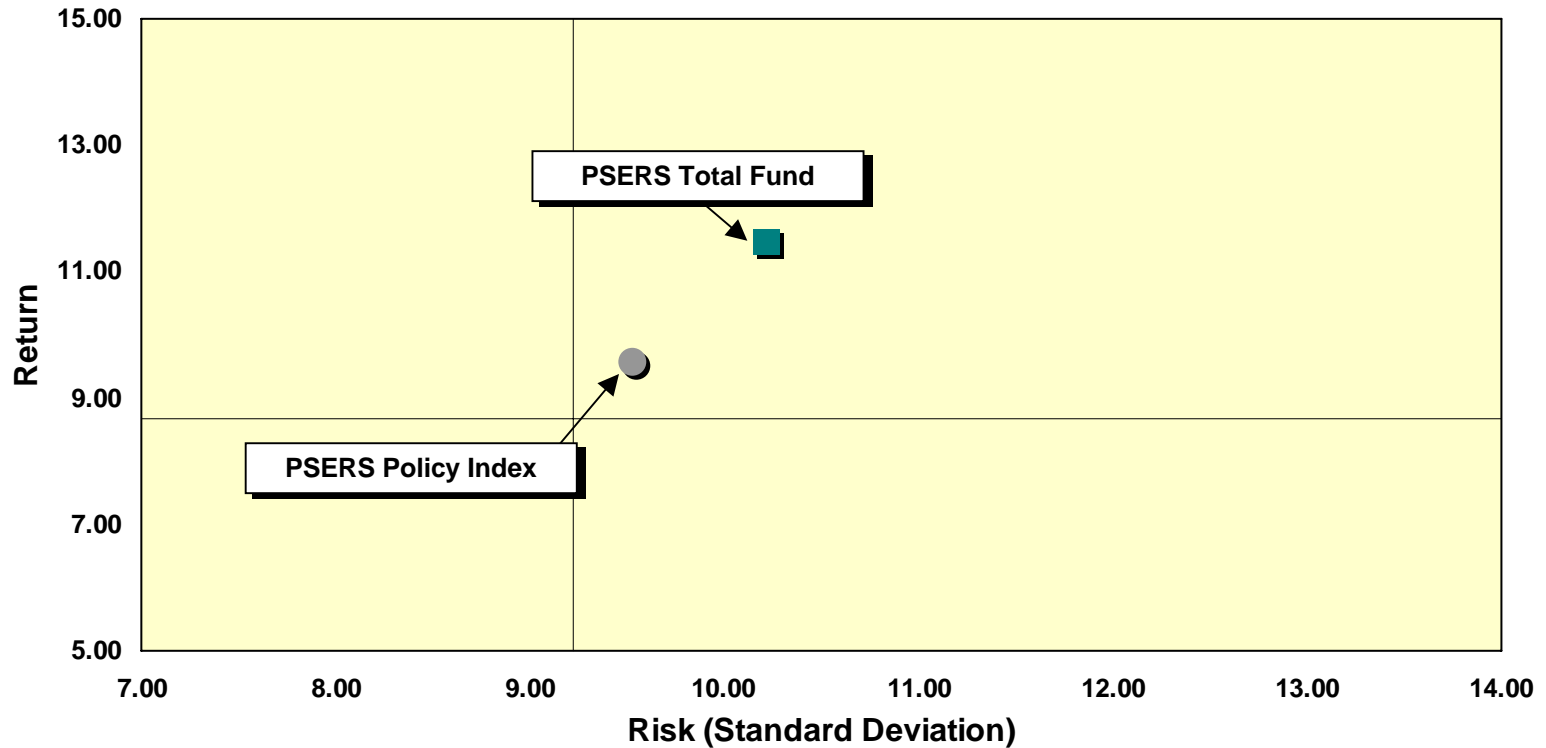
Risk / Return Analysis

PSERS Total Fund vs All Public Funds *
Seven-Year Period Ending December 31, 2006

* Net of Fees

Performance Comparison – US Equity *

PSERS vs All Public Funds
For Periods Ending December 31, 2006
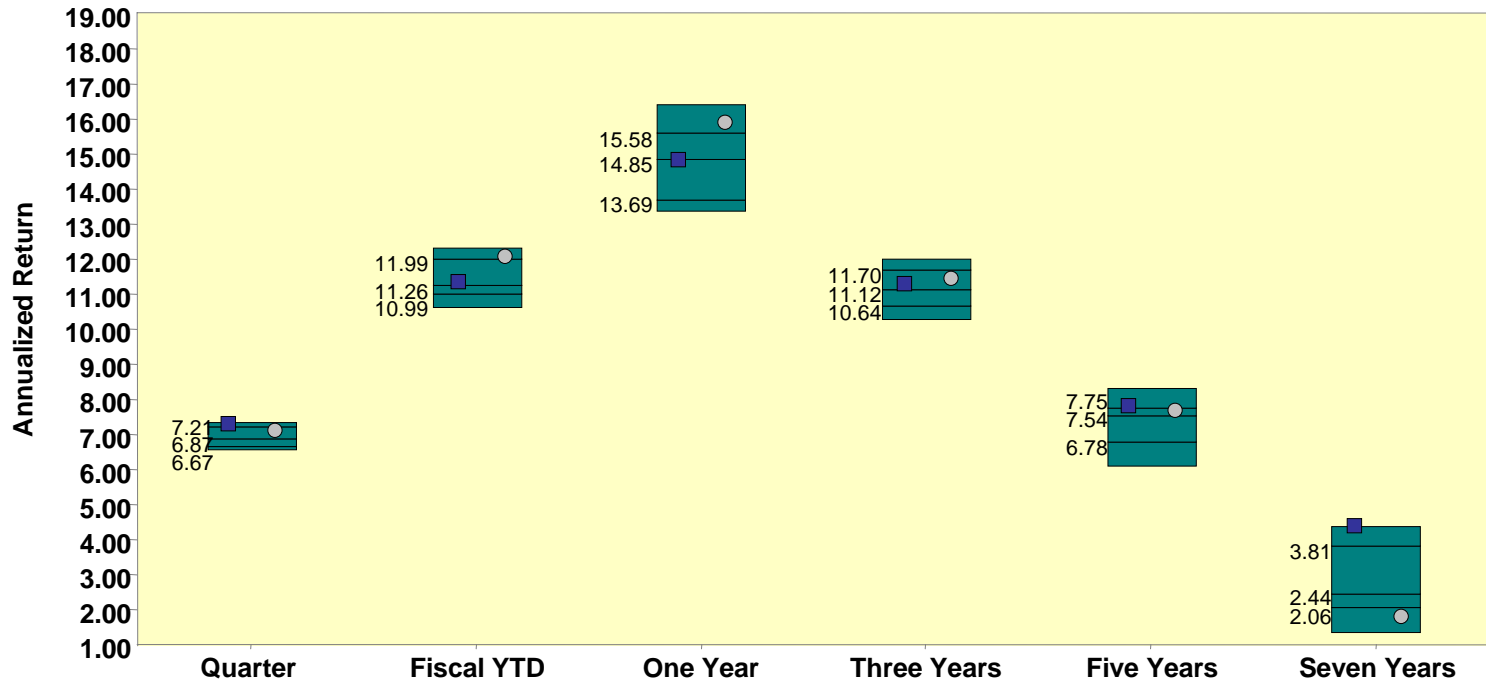
	Quarter	Fiscal YTD	One Year	Three Years	Five Years	Seven Years
■ Total US Equity	7.23 (20)	11.24 (54)	14.84 (52)	11.18 (46)	7.71 (35)	4.35 (11)
○ DJ Wil 5000 Index	7.20 (26)	11.99 (25)	15.77 (19)	11.47 (32)	7.61 (43)	1.95 (81)
Number of Funds	46	46	46	39	37	36

* Net of Fees

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Performance Comparison – US Equity *

PSERS vs Large Public Funds ^
For Periods Ending December 31, 2006

	Quarter	Fiscal YTD	One Year	Three Years	Five Years	Seven Years
Large Public Funds						
PSERS US Equity Composite	**7.23%**	**11.24%**	**14.84%**	**11.18%**	**7.71%**	**4.35%**
DJ Wilshire 5000 Index	7.20%	11.99%	15.77%	11.47%	7.61%	1.95%
Variance	**+0.03%**	**-0.75%**	**-0.93%**	**-0.29%**	**+0.10%**	**+2.40%**
Large Public Fund A	6.93%	11.57%	14.48%	10.96%	6.79%	1.36%
Large Public Fund B	6.93%	11.59%	14.98%	10.91%	7.10%	2.07%
Large Public Fund C	6.94%	11.45%	14.49%	10.84%	5.85%	1.07%
Large Public Fund D	7.23%	11.17%	14.65%	11.73%	7.53%	2.32%
Large Public Fund E	6.66%	12.24%	15.27%	10.65%	6.50%	2.22%
Large Public Fund F	6.66%	12.20%	15.22%	10.63%	6.66%	2.12%
Large Public Fund G	5.21%	6.77%	10.28%	9.18%	6.10%	4.15%
Large Public Fund H	6.94%	12.00%	15.62%	10.53%	6.95%	1.90%
Large Public Fund I	7.17%	12.05%	15.84%	11.52%	7.55%	2.21%

* Net of Fees
^ Over $10 Billion

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Performance Comparison – Non-US Equity *

PSERS vs All Public Funds
For Periods Ending December 31, 2006
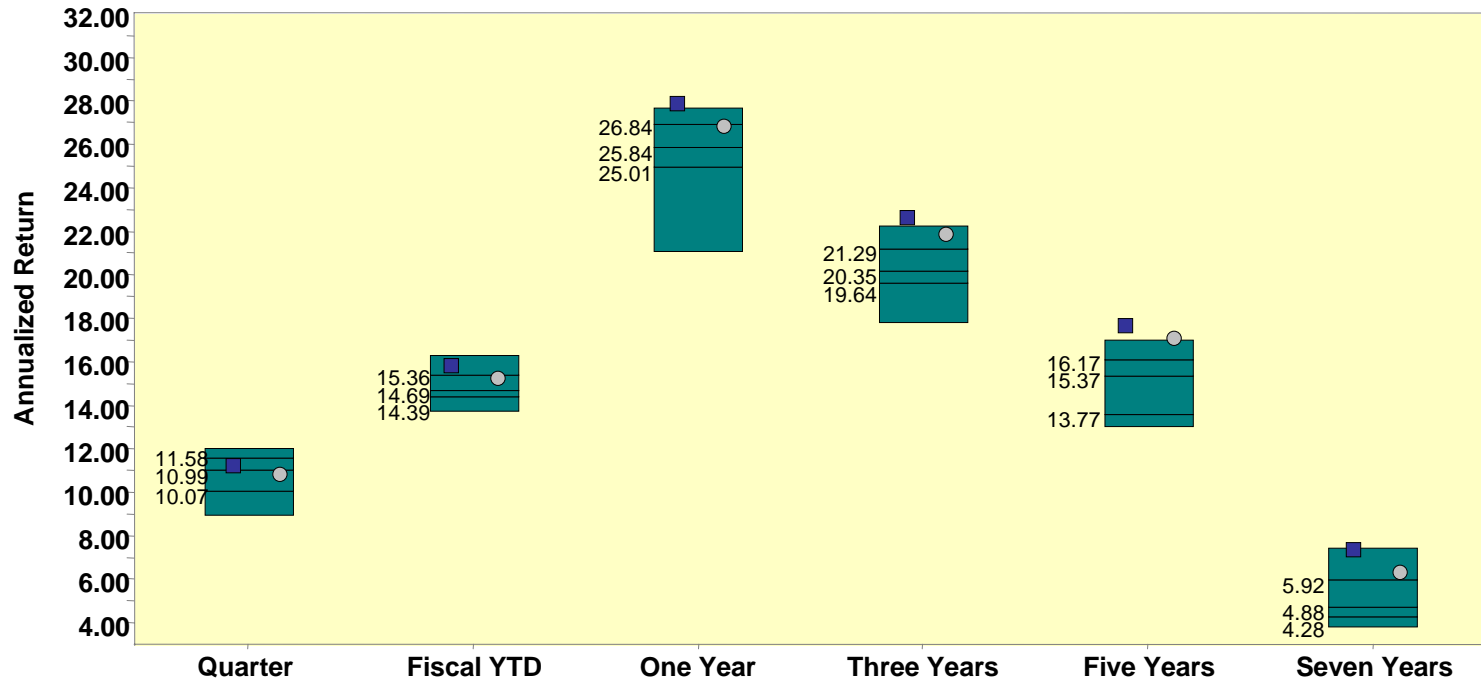
	Quarter	Fiscal YTD	One Year	Three Years	Five Years	Seven Years
■ Total Non-US Eq	10.99 (50)	15.54 (17)	27.66 (10)	22.36 (6)	17.52 (3)	6.58 (18)
○ Policy Index ^	10.37 (64)	15.06 (44)	26.55 (27)	21.61 (17)	16.76 (15)	5.80 (33)
Number of Funds	44	43	43	37	35	35

* Net of Fees
^ MSCI ACW x-US 30% Hedged [21% MSCI ACW x-US USD / 9% MSCI ACW x-US LC]

Performance Comparison – Non-US Equity *

PSERS vs Large Public Funds ^
For Periods Ending December 31, 2006

|	Quarter	Fiscal YTD	One Year	Three Years	Five Years	Seven Years
Large Public Funds						
PSERS Non-US Equity Composite	**10.99%**	**15.54%**	**27.66%**	**22.36%**	**17.52%**	**6.58%**
MSCI ACW x-US Index ^^	10.37%	15.06%	26.55%	21.61%	16.76%	5.80%
Variance	**+0.62%**	**+0.48%**	**+1.11%**	**+0.75%**	**+0.76%**	**+0.78%**
Large Public Fund A	11.06%	15.46%	26.95%	21.04%	16.19%	5.50%
Large Public Fund B	--	--	--	--	--	--
Large Public Fund C	10.88%	15.49%	26.29%	21.09%	15.29%	5.81%
Large Public Fund D	10.15%	14.50%	26.25%	21.04%	16.06%	5.64%
Large Public Fund E	8.89%	13.72%	21.04%	19.95%	13.27%	4.40%
Large Public Fund F	8.89%	13.72%	21.08%	19.96%	13.29%	4.41%
Large Public Fund G	10.73%	15.29%	27.05%	19.35%	14.41%	3.93%
Large Public Fund H	11.20%	15.31%	26.27%	20.72%	15.95%	5.03%
Large Public Fund I	11.23%	15.89%	27.12%	21.58%	16.51%	6.04%

* Net of Fees
^ Over $10 Billion
^^ MSCI ACW x-US 30% Hedged [21% MSCI ACW x-US USD / 9% MSCI ACW x-US LC]

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Performance Comparison – US Fixed Income [*]

PSERS vs All Public Funds
For Periods Ending December 31, 2006
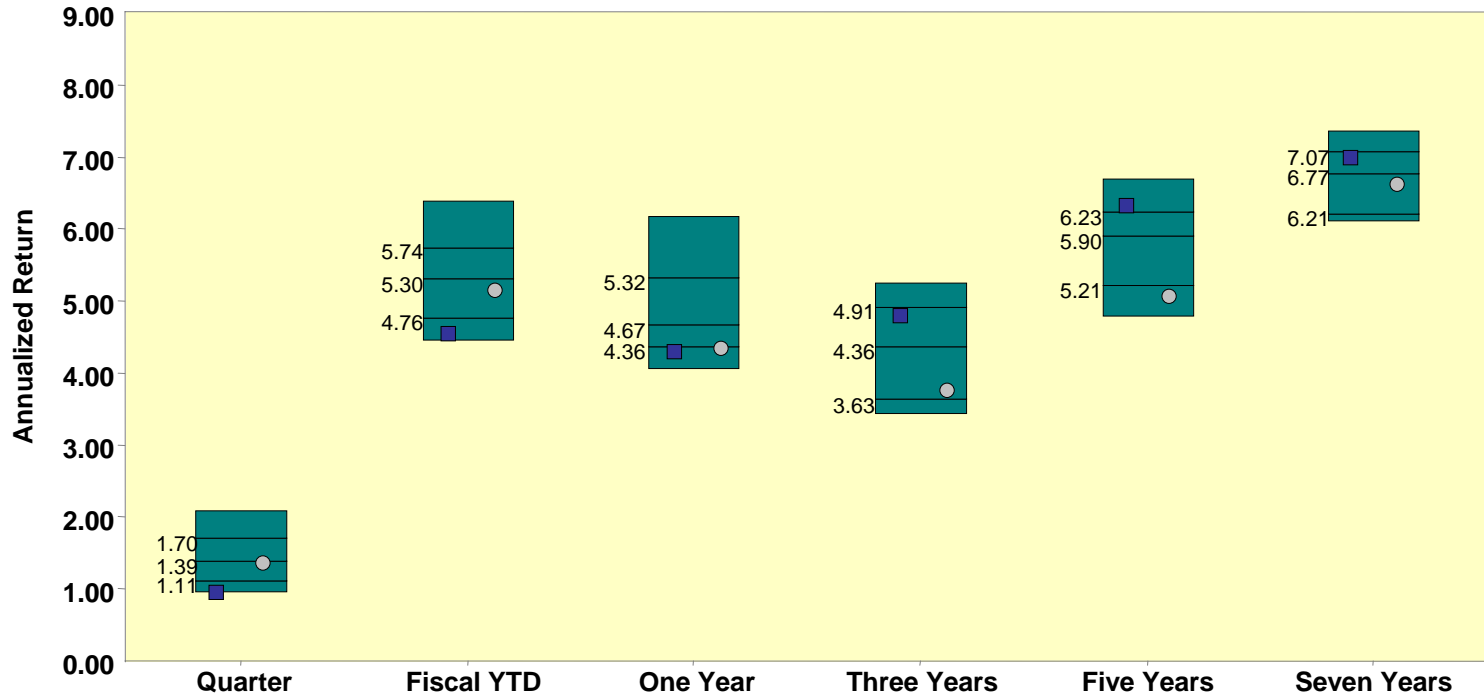
	Quarter	Fiscal YTD	One Year	Three Years	Five Years	Seven Years
■ Total US Fixed	0.94 (95)	4.55 (82)	4.21 (80)	4.65 (32)	6.36 (23)	7.09 (44)
○ Leh Agg Index	1.24 (64)	5.09 (66)	4.33 (76)	3.70 (72)	5.06 (80)	6.46 (66)
Number of Funds	45	45	45	38	36	35

* Net of Fees

Performance Comparison – US Fixed Income *

PSERS vs Large Public Funds ^
For Periods Ending December 31, 2006

	Quarter	Fiscal YTD	One Year	Three Years	Five Years	Seven Years
Large Public Funds						
PSERS US Fixed Composite	**0.94%**	**4.55%**	**4.21%**	**4.65%**	**6.36%**	**7.09%**
Lehman Aggregate Index	1.24%	5.09%	4.33%	3.70%	5.06%	6.46%
Variance	**-0.30%**	**-0.54%**	**-0.12%**	**+0.95%**	**+1.30%**	**+0.63%**
Large Public Fund A	1.34%	5.13%	4.71%	4.15%	5.39%	6.82%
Large Public Fund B	1.37%	6.54%	4.80%	5.54%	6.79%	7.94%
Large Public Fund C	1.27%	5.03%	4.65%	4.12%	6.09%	6.98%
Large Public Fund D	--	--	--	--	--	--
Large Public Fund E	1.11%	4.46%	4.68%	3.63%	4.80%	6.21%
Large Public Fund F	1.11%	4.46%	4.68%	3.63%	4.80%	6.21%
Large Public Fund G	1.93%	5.69%	6.32%	5.20%	6.19%	5.96%
Large Public Fund H	1.56%	5.38%	5.41%	4.57%	6.01%	6.77%
Large Public Fund I	1.12%	5.11%	4.72%	4.32%	5.89%	7.06%

* Net of Fees
^ Over $10 Billion

Real Estate and Alternative Investments

Composite Investment Performance vs Benchmarks
For Periods Ending December 31, 2006

	Quarter	Fiscal YTD	One Year	Three Years	Five Years
Real Estate Composite	**7.70%**	**13.13%**	**34.94%**	**29.75%**	**21.77%**
Real Estate Policy ^	6.14%	11.48%	22.97%	19.26%	14.92%
Variance	**+1.56%**	**+1.65%**	**+11.97%**	**+10.49%**	**+6.85%**
Alternative Inv Composite	**3.20%**	**9.57%**	**21.96%**	**23.14%**	**13.93%**
Venture Econ Index *(Lagged)*	3.25%	4.94%	12.32%	10.07%	4.49%
Variance	**-0.05%**	**+4.63%**	**+9.64%**	**+13.07%**	**+9.44%**

^ 75% NCREIF (Private Real Estate) and 25% FTSE EPRA / NAREIT Global (REITs)

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Tab 2

Asset / Liability Analysis

Asset / Liability Analysis

The Role of Asset Allocation

- Asset allocation is the process of selecting a policy portfolio that allocates assets among asset classes that have the potential to serve the financial objectives of the plan.

    - Wilshire believes that the core mission of a defined benefit plan is to fund the benefits promised to participants.

    - The role of asset allocation is to manage the risk to the core mission.

    - The primary goal of asset allocation is to *maximize the safety* of promised benefits and *minimize the cost* of funding the benefits - Wilshire's Asset Liability Valuation (ALV) model provides a methodology for selecting a policy portfolio that achieves both of these goals.

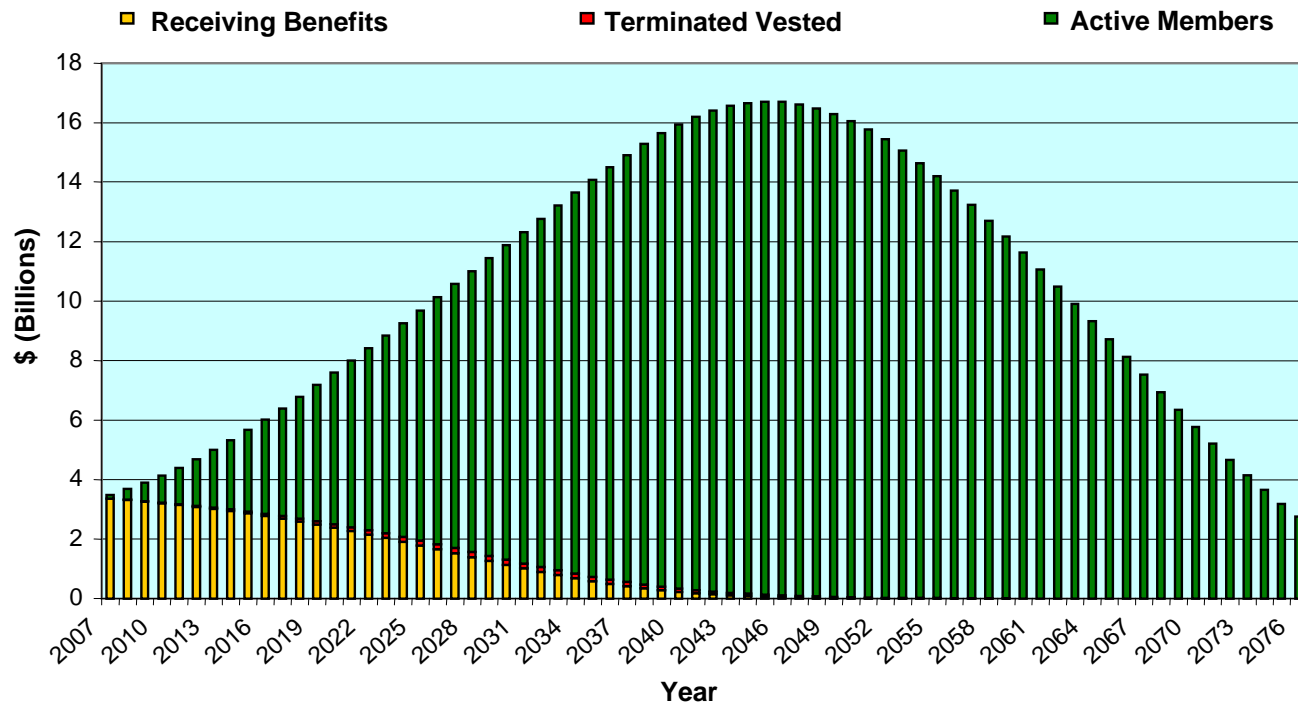# Asset / Liability Analysis

Plan Statistics

($ - Billions)

	June 30, 2005	June 30, 2006
Market Value of Assets[a]	52.033534	57.328444
Present Value of Future Pension Benefits[b]	75.085371	80.250936
Present Value of Future Employee Contributions[c]	7.275650	8.131437
Additional Plan Cost[d] (b. -a. -c.)	**15.776187**	**14.791055**
Present Value of Future Compensation[e]	100.910541	112.157752
Additional Plan Cost as a Percentage of Payroll[f] (d/e)	**15.63%**	**13.19%**

Economic Assumptions	
	8.50%
Discount Rate	
Inflation	**3.25%**
Salary Increase Rate	**Varies by Age**

Additional Plan Cost and Additional Plan Cost as a Percentage of Payroll are based on a fixed discount rate, a fixed inflation rate, and fixed salary increase rates. Wilshire has analyzed these costs stochastically - considering the volatilities of the benefit commitment, contribution amounts, and asset return - identifying policy portfolios which maximize benefit safety and minimize the cost of funding these benefits.

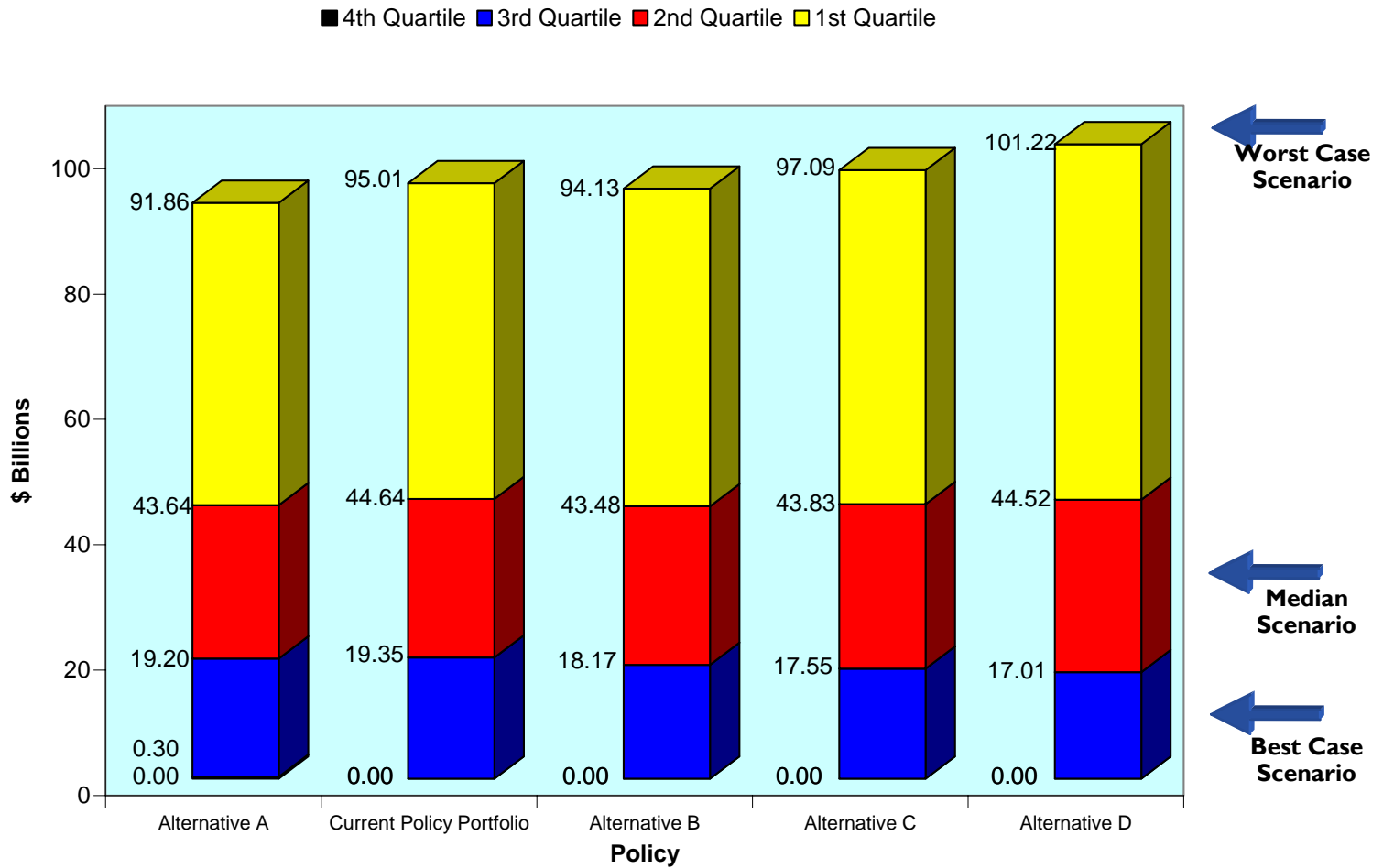WILSHIRE
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Asset / Liability Analysis

Plan Commitment

- Projected by Wilshire – from information provided by Buck Consultants in the actuarial valuation - the benefit commitment includes projections of future pay and service for the current participant population
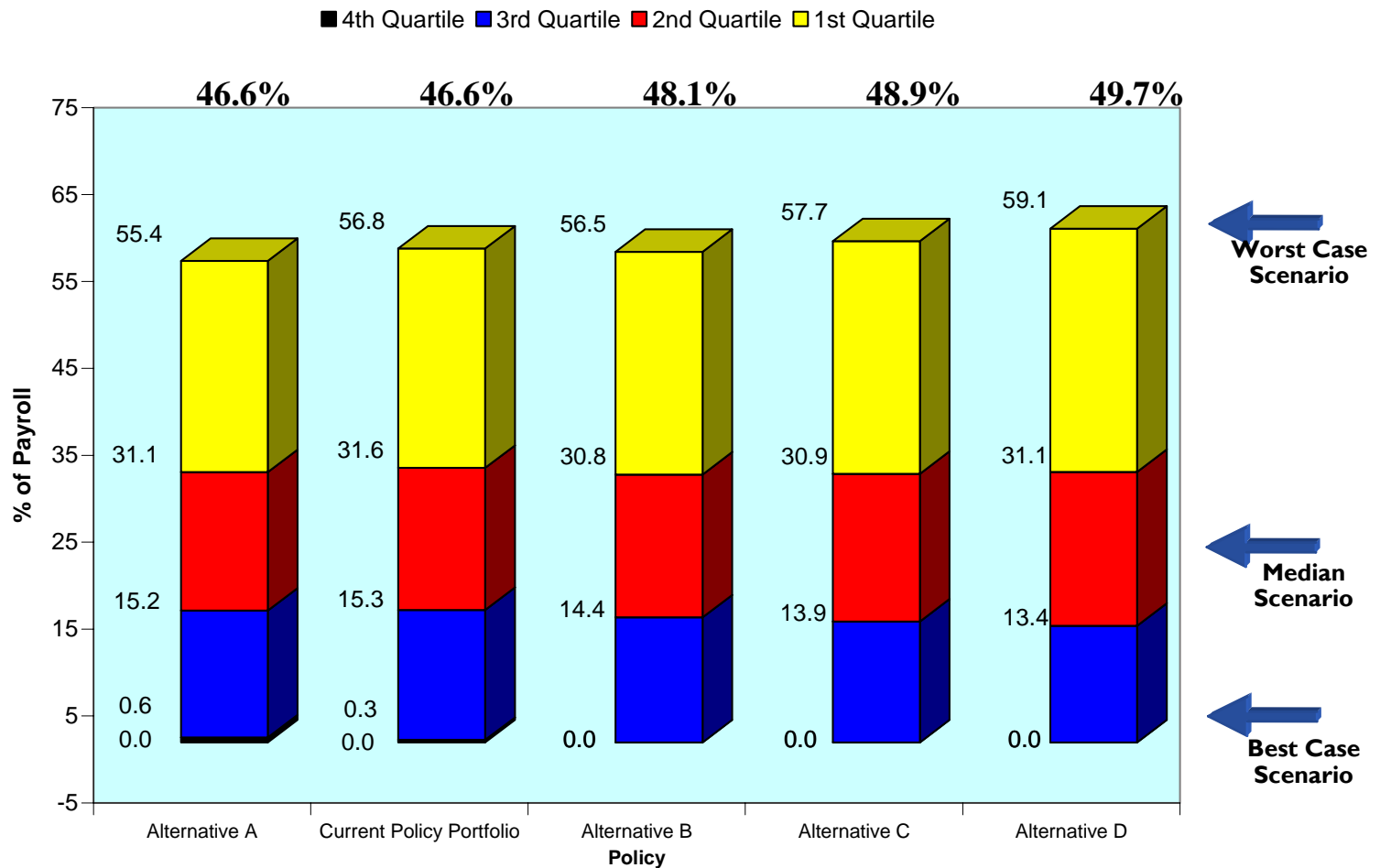
Asset / Liability Analysis

Distribution of Additional Cost

Legend: ■ 4th Quartile ■ 3rd Quartile ■ 2nd Quartile □ 1st Quartile

	Alternative A	Current Policy Portfolio	Alternative B	Alternative C	Alternative D
Worst Case Scenario	91.86	95.01	94.13	97.09	101.22
Median Scenario	43.64	44.64	43.48	43.83	44.52
	19.20	19.35	18.17	17.55	17.01
Best Case Scenario	0.30	0.00	0.00	0.00	0.00
	0.00				

Y-axis: $ Billions — 0, 20, 40, 60, 80, 100

X-axis: Policy

Additional Cost is the cost – as of January 1, 2007 - above assets and member contributions to fund the benefit commitment.

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Asset / Liability Analysis

Distribution of Annual Cost as a Percentage of Payroll

Additional Cost as Percentage of Payroll using the fixed economic variables in the valuation report is 13.19%. The percentages above the graph show the probability of this level being sufficient with each portfolio.

Asset / Liability Analysis

Asset Allocation Process – Inputs

- Capital market expectations
  - Expected return
  - Expected risk
  - Expected correlation

- Portfolio optimization
  - Asset class constraints
  - Efficient frontier analysis
  - Model policy portfolios

- Asset allocation modeling

- Asset / liability simulation

Asset / Liability Analysis

Asset Allocation Process – Return Expectations
2006 vs 2007

	2006	2007	Difference
US Equity	8.25%	8.25%	--
Non-US Equity	8.25%	8.25%	--
Fixed Income	5.00%	5.25%	+0.25%
TIPS	4.75%	5.00%	+0.25%
Real Estate	5.25%	6.75%	+1.50%
REITs	6.25%	5.75%	-0.50%
Private Markets	11.75%	11.75%	--
Commodities	5.25%	4.25%	-1.00%
Cash Equivalents	3.00%	3.00%	--
Inflation (CPI)	2.25%	2.25%	--

Asset / Liability Analysis

Asset Allocation Process – Wilshire's Asset Class Assumptions

- Wilshire's asset class return, risk and correlation assumptions are developed based on 10-year forward looking expected rates of return and historical risk and correlation, adjusted to incorporate recent trends.

- Return expectations represent a passive investment in the asset class **(beta)**. They do not reflect value added from active management **(alpha)**.

	US Equity	Non-US Equity *(Unhedged)*	Non-US Equity *(Hedged)*	US Fixed Income	High Yield	TIPS	Global Fixed Income	Private Markets	Real Estate	REITs	Commodities
Return (%)	8.25	8.25	8.15	5.25	6.75	5.00	5.00	11.75	6.75	5.75	4.25
Risk (%)	16.00	18.00	17.00	5.00	10.00	6.00	10.00	29.00	12.50	15.00	13.00
US Equity	1.00	0.77	0.82	0.29	0.48	-0.05	-0.01	0.73	0.34	0.35	0.00
Non-US Equity *(Unhedged)*		1.00	0.79	0.05	0.35	0.05	0.32	0.61	0.24	0.25	0.20
Non-US Equity *(Hedged)*			1.00	0.04	0.40	-0.05	-0.07	0.65	0.24	0.25	0.15
US Fixed Income				1.00	0.39	0.20	0.33	0.30	0.24	0.15	0.00
High Yield					1.00	0.01	0.01	0.31	0.37	0.30	0.08
TIPS						1.00	0.05	0.01	0.16	0.15	0.20
Global Fixed Income							1.00	0.04	0.14	0.05	0.15
Private Markets								1.00	0.32	0.35	0.02
Real Estate									1.00	0.82	0.21
REITs										1.00	0.20
Commodities											1.00

Asset / Liability Analysis

Background

The Underfunded Status of Pension Funds

- Demographic shifts

  - Aging baby boomers

  - Plan membership – more retirees than active participants

  - Retirees are living longer

  - Pressure to continue to improve benefits

- Capital market opportunities

  - Compression of global risk premia

  - Single digit equity return expectations

  - Low interest rate environment

  - Low inflation environment

- Increased contribution requirements

  - Budgetary shortfalls

  - Earnings expectations

  - Expectations for slower long-term economic growth in developed countries

Asset / Liability Analysis

Background

- A low total return environment is expected

  - Long-term bond yields remain relatively low (4.5%) / flat yield curve
  - Credit spreads remain tight
  - Real estate valuations are at historic highs

- The disconnect between required hurdle rates and low expected returns has created pressure on pension funds

- Institutional investors are actively seeking higher returns in non-traditional asset classes (private equity, real estate, hedge funds)

- PSERS has implemented / considered a number of strategies to enhance the risk / return profile of the fund

  - Use of TIPS (treasury inflation protection securities) to reduce inflationary risk
  - Broader diversification of investment structure
    - Micro-cap US equity, small non-US equity, emerging markets style
  - Overweight to small cap, combined with a structured approach to large cap investing
  - Global macro alpha overlay strategies to enhance return
  - Commodity allocation to reduce total fund risk (funding tactically)
  - Consider leveraging certain beta exposures
  - Relax short constraint for certain managers (130 / 30 strategy)

Asset / Liability Analysis

Current Industry Observations

- Two major developments in pensions

    - Slow but steady reduction of the use of DB plans in favor of DC plans

        - Largely a corporate pension phenomenon thus far

        - Places market risk on plan participants rather than plan sponsors

    - Greater ability to separate alpha and beta

        - More precise and efficient control of beta through derivatives

        - Ability to adjust beta exposure higher (leverage) or lower (hedge)

        - Cheap access to beta, must pay for alpha

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Asset / Liability Analysis

Historical Observations and Current Conditions

- PSERS funded status peaked in the March – June 2000 period on both a market value and an actuarial value basis.

- The combination of negative equity returns from March 2000 through March 2003 and pension legislation to improve benefits (multiplier change and COLA) in 2000 had a meaningful and negative impact on the funded status of PSERS.

- At June 30, 2006, the funded ratio based on the market value of assets was approximately 89%, up from the 85% as of June 30, 2005. Based on the actuarial value of assets (five-year smoothing technique), the funded ratio as of June 30, 2006 was approximately 81%, down from the 84% as of June 30, 2005.

- The current asset allocation policy for PSERS is expected to generate a long-term return of 8.21%. No expected alpha has been modeled in this analysis. [*]

- The actuarial discount rate assumption is 8.50%. There is a 29 basis point annual difference between the long-term expected return (beta) and the actuarial discount rate assumption. [*]

- Wilshire uses the market value of assets for asset allocation policy analysis.

* The 29 basis point annual difference excludes the anticipated "alpha" from active management. Should alpha have been modeled, we would anticipate that the expected return (alpha plus beta) would reach the actuarial discount rate assumption of 8.50%.
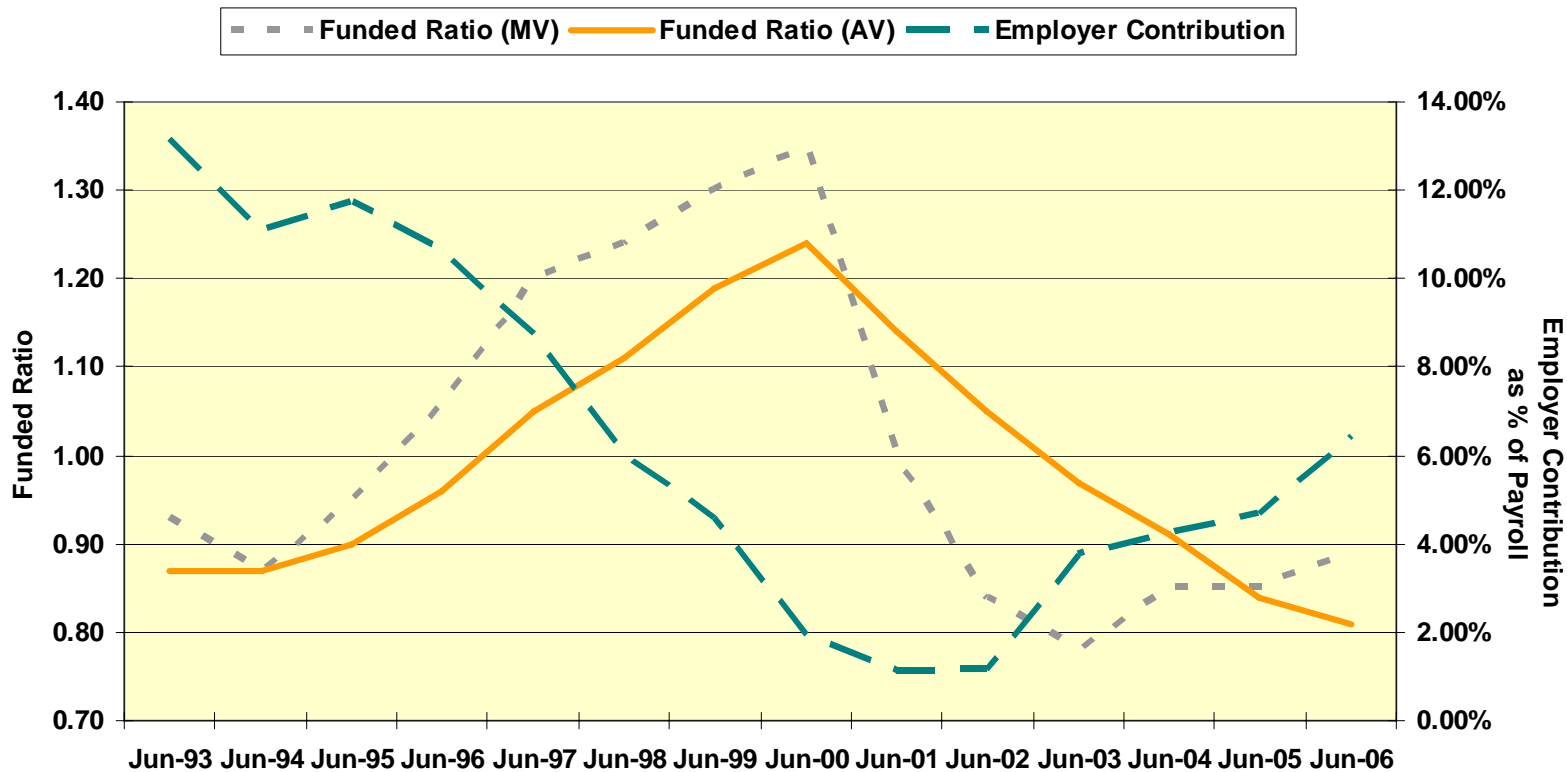
Asset / Liability Analysis

Historical Perspective – Asset and Liability Growth
June 1993 Through June 2006
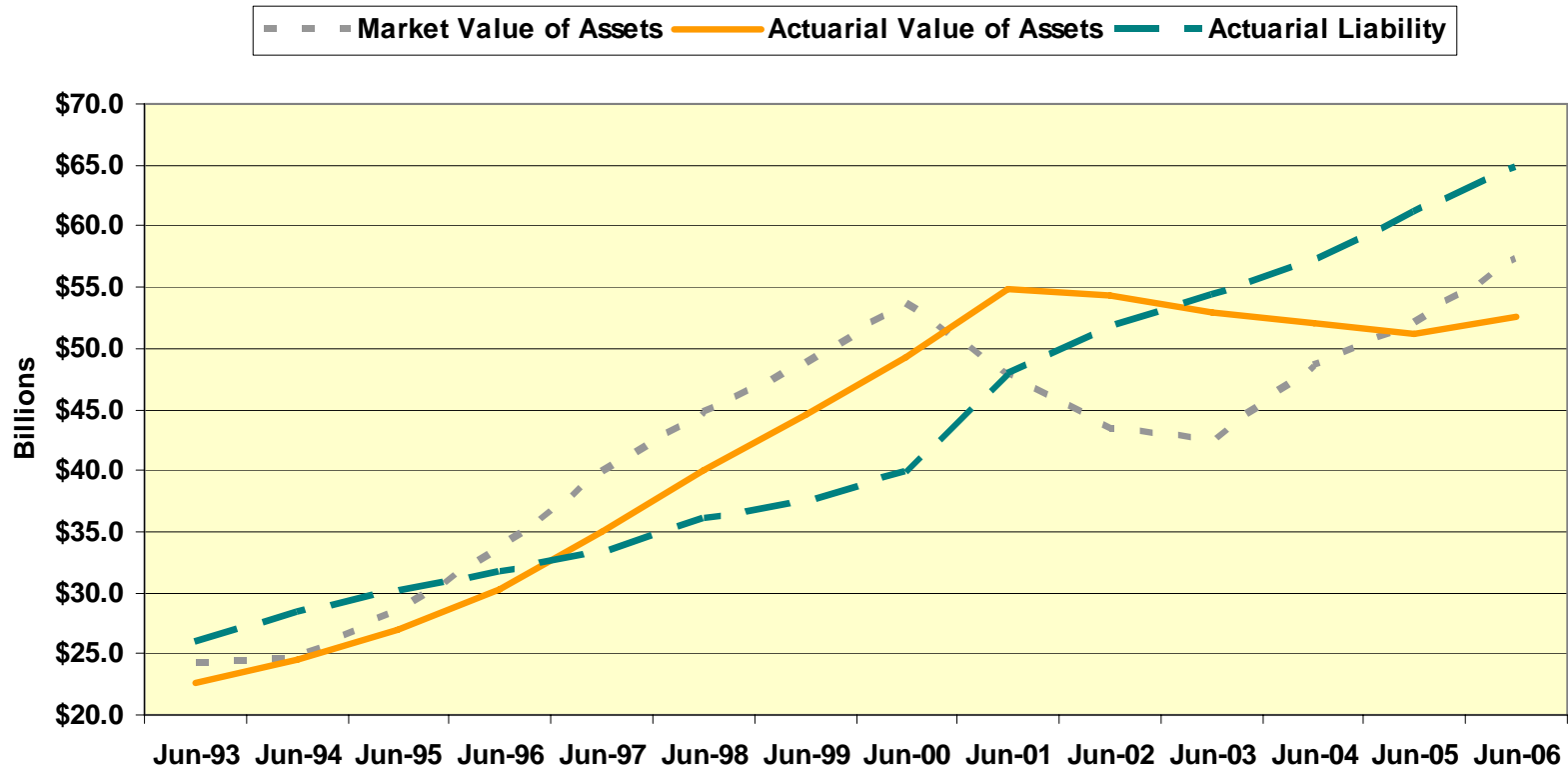
Asset / Liability Analysis

Historical Perspective – Funded Ratios vs Employer Contributions
*June 1993 Through June 2006*

Asset / Liability Analysis

Expected Conditions

- A ten-year planning horizon (June 2006 through June 2016) is used in the analysis.

- Four alternative portfolios were tested to determine the simulated impact of asset allocation policy on future funding levels.

- Employee contributions are assumed to remain stable at approximately 7% of payroll. Given current funding conditions and market expectations, increased employer contributions will be required in order to improve the funded status.

- Over the next ten years, the projected market value of assets is expected to grow to approximately $81 billion, based on the current allocation.

- Accrued liabilities are expected to grow to approximately $93 billion over the next ten years.

- Based on the demographic profile of the PSERS membership, the inactive population is expected to grow steadily over the next ten years.
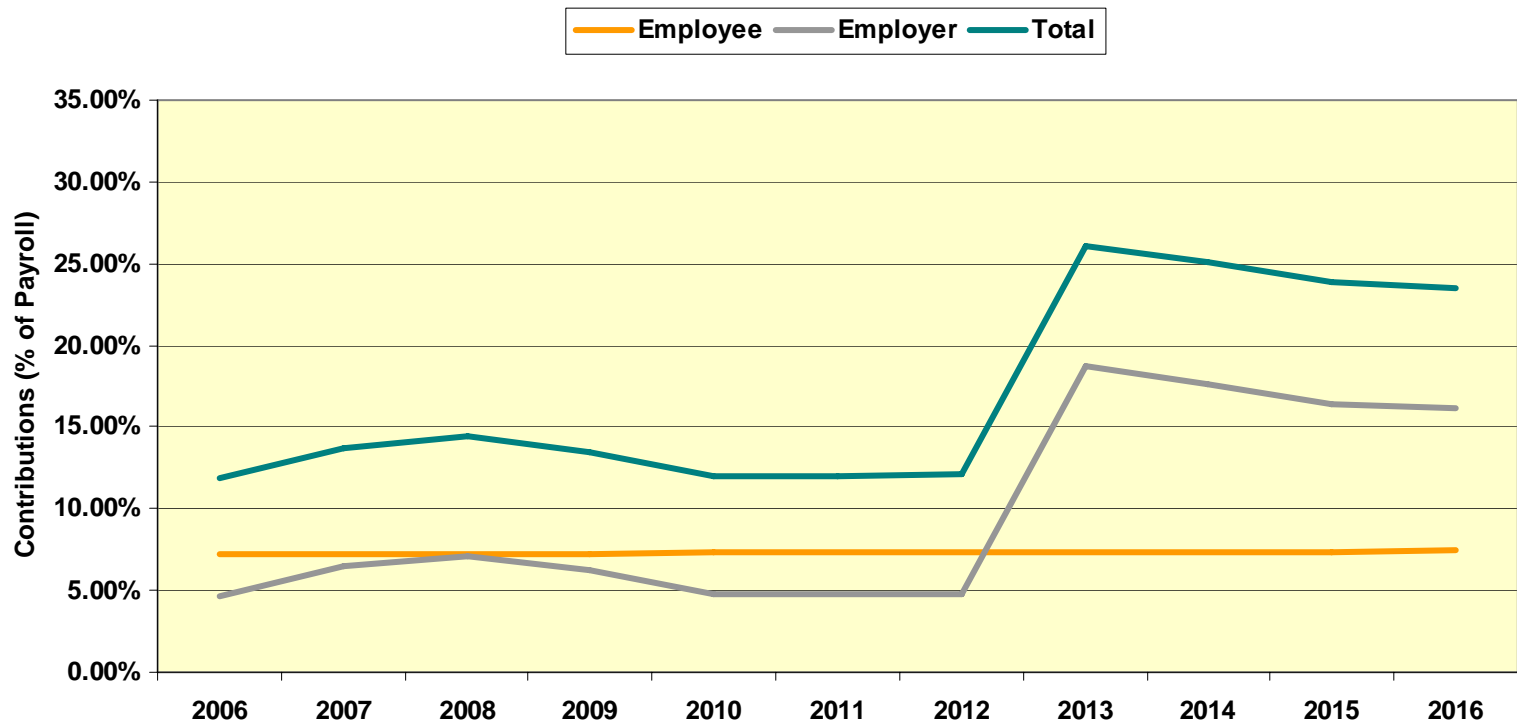
Asset / Liability Analysis

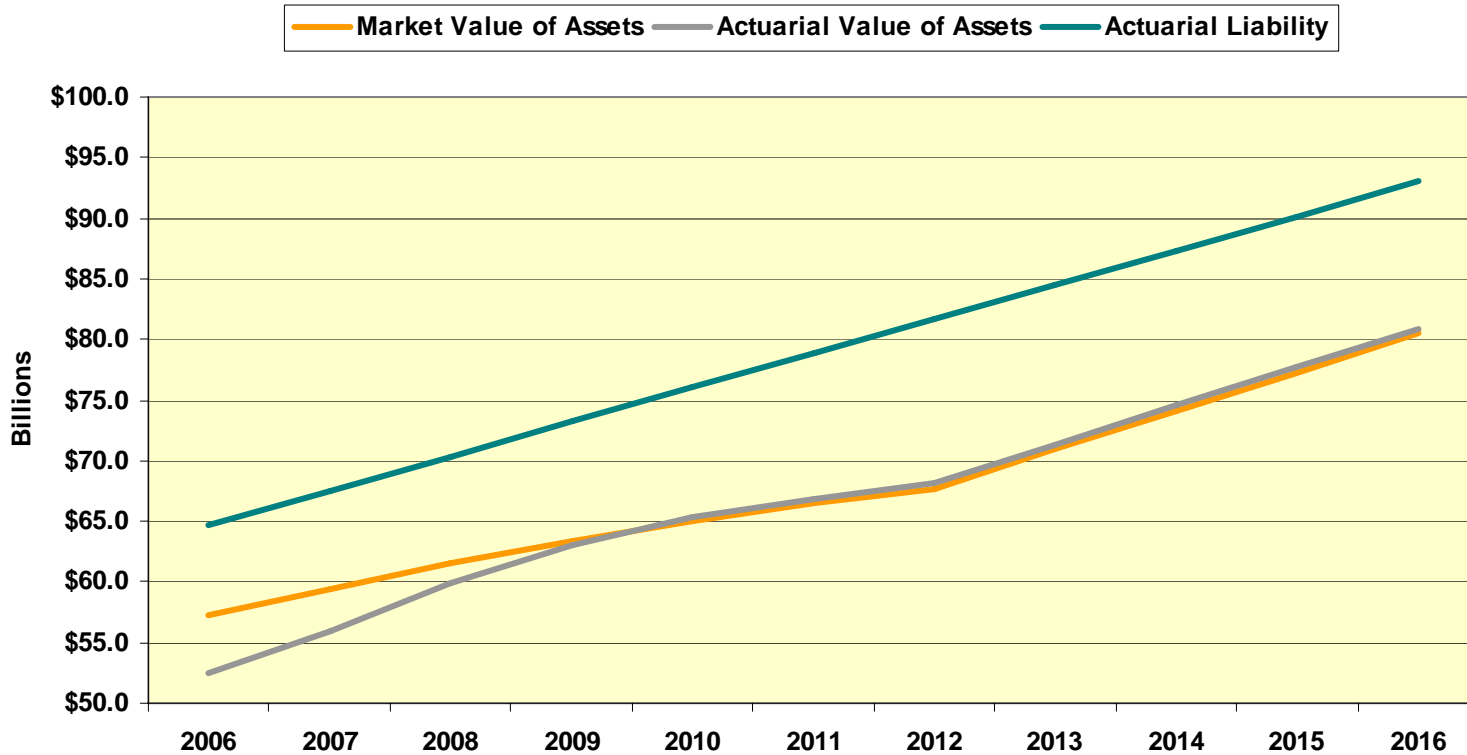## Expected Conditions
Membership Demographics
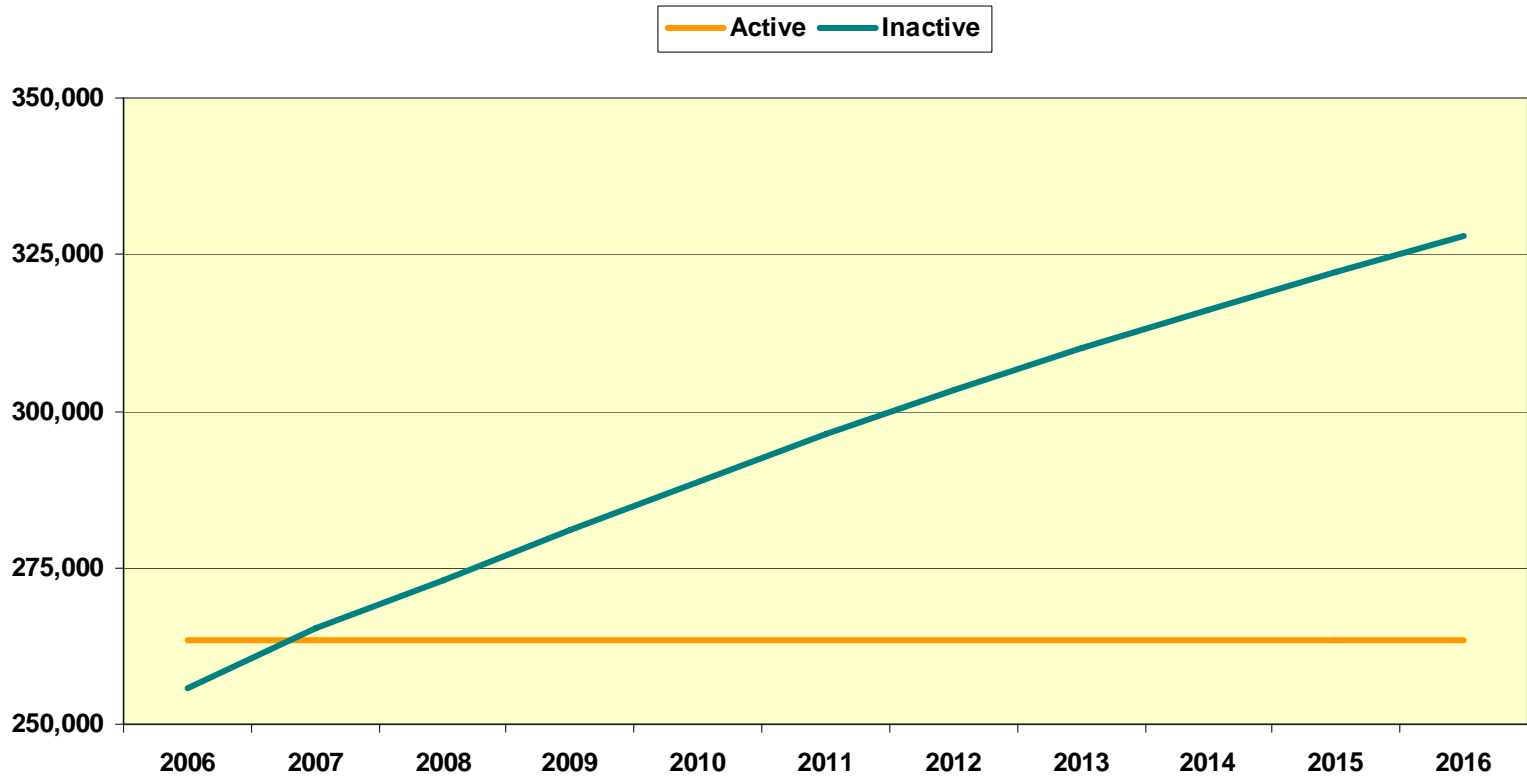
Asset / Liability Analysis

Expected Conditions
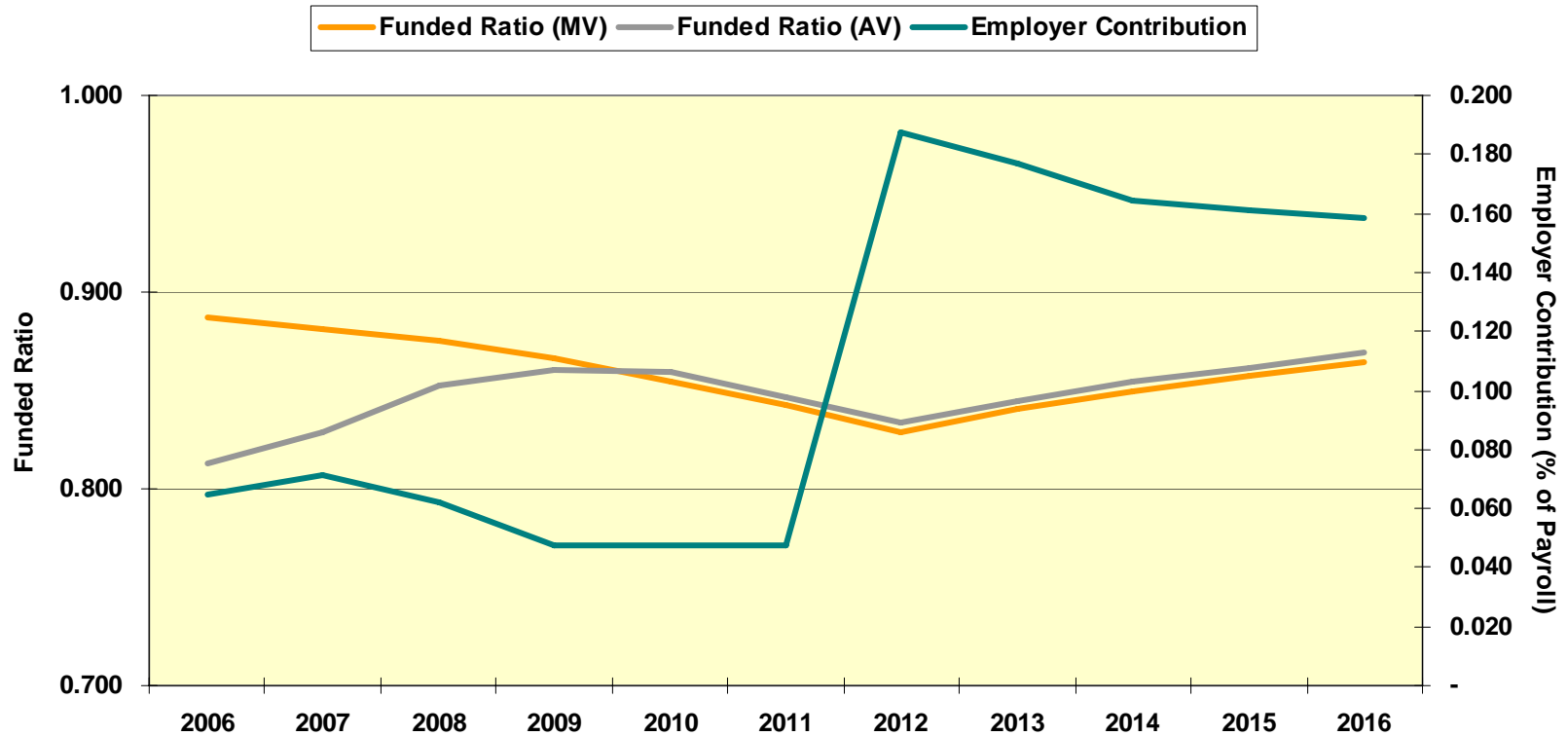*Contribution Rates*

Asset / Liability Analysis

Expected Conditions
Asset and Liability Growth

Asset / Liability Analysis

Expected Conditions
Funded Ratios vs Employer Contributions
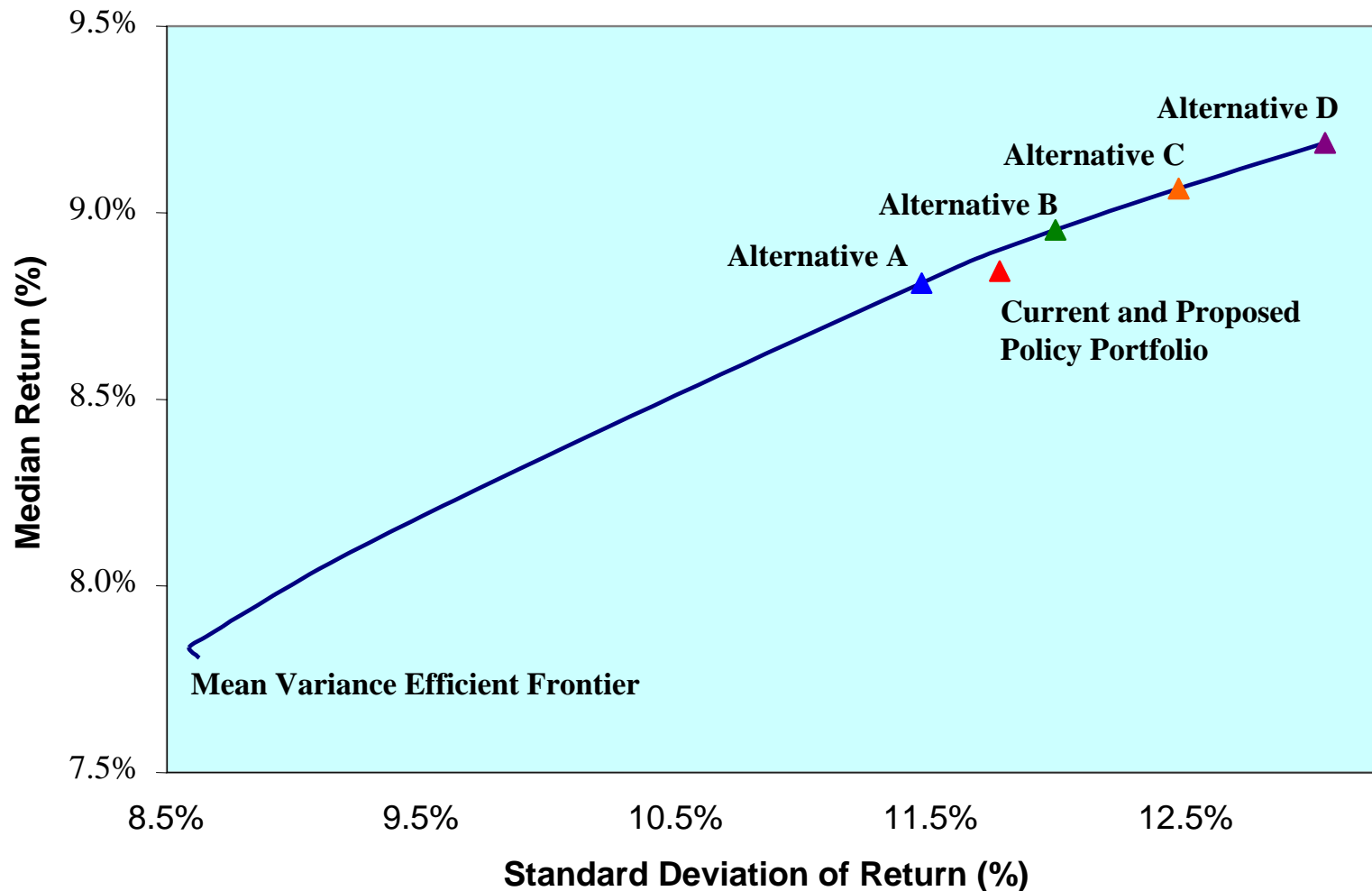
Asset / Liability Analysis

Alternative Portfolios *

	Policy A	Proposed Policy	Policy B	Policy C	Policy D
US Equity	24%	27%	27%	30%	32%
Non-US Equity (Unhedged)	17%	19%	19%	21%	22%
Non-US Equity (Hedged)	7%	8%	8%	9%	10%
Total Equity	**48%**	**54%**	**54%**	**60%**	**64%**
US Core Fixed Income	8%	13%	7%	7%	10%
High Yield	5%	1%	5%	5%	5%
TIPS	5%	5%	5%	5%	0%
Global Fixed Income	4%	3%	3%	3%	5%
Total Fixed Income	**22%**	**22%**	**20%**	**20%**	**20%**
Private Real Estate	10%	6%	8%	4%	0%
REITs	3%	2%	3%	1%	0%
Total Real Estate	**13%**	**8%**	**11%**	**5%**	**0%**
Private Markets	**11%**	**11%**	**11%**	**11%**	**11%**
Commodities	**5%**	**5%**	**5%**	**5%**	**5%**
Median Return	**8.21%**	**8.21%**	**8.30%**	**8.36%**	**8.42%**
Standard Deviation of Return	**11.46%**	**11.77%**	**11.98%**	**12.47%**	**13.04%**
Return / Risk	**0.72**	**0.70**	**0.69**	**0.67**	**0.65**
Increase / Decrease (bps) on Expected					
Return	**--**	**--**	**+9**	**+15**	**+20**
Standard Deviation	**(31)**	**--**	**+22**	**+70**	**+128**

* The returns modeled are "beta" only returns. Should alpha have been modeled, we would anticipate that the expected return *(alpha plus beta)* would reach the actuarial discount rate assumption of 8.50%.
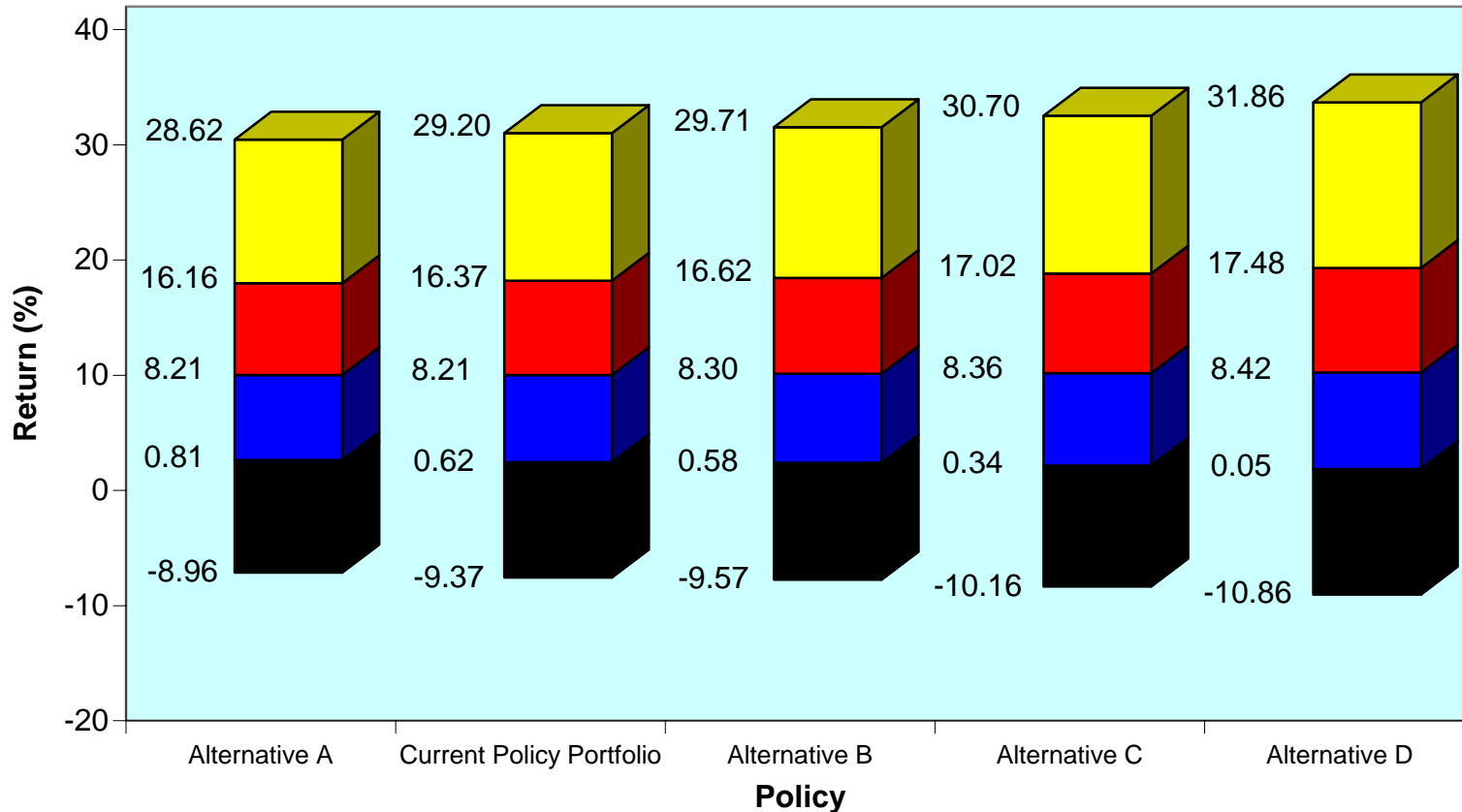
Asset / Liability Analysis

Portfolio Optimization
Risk and Return of Alternative Portfolios
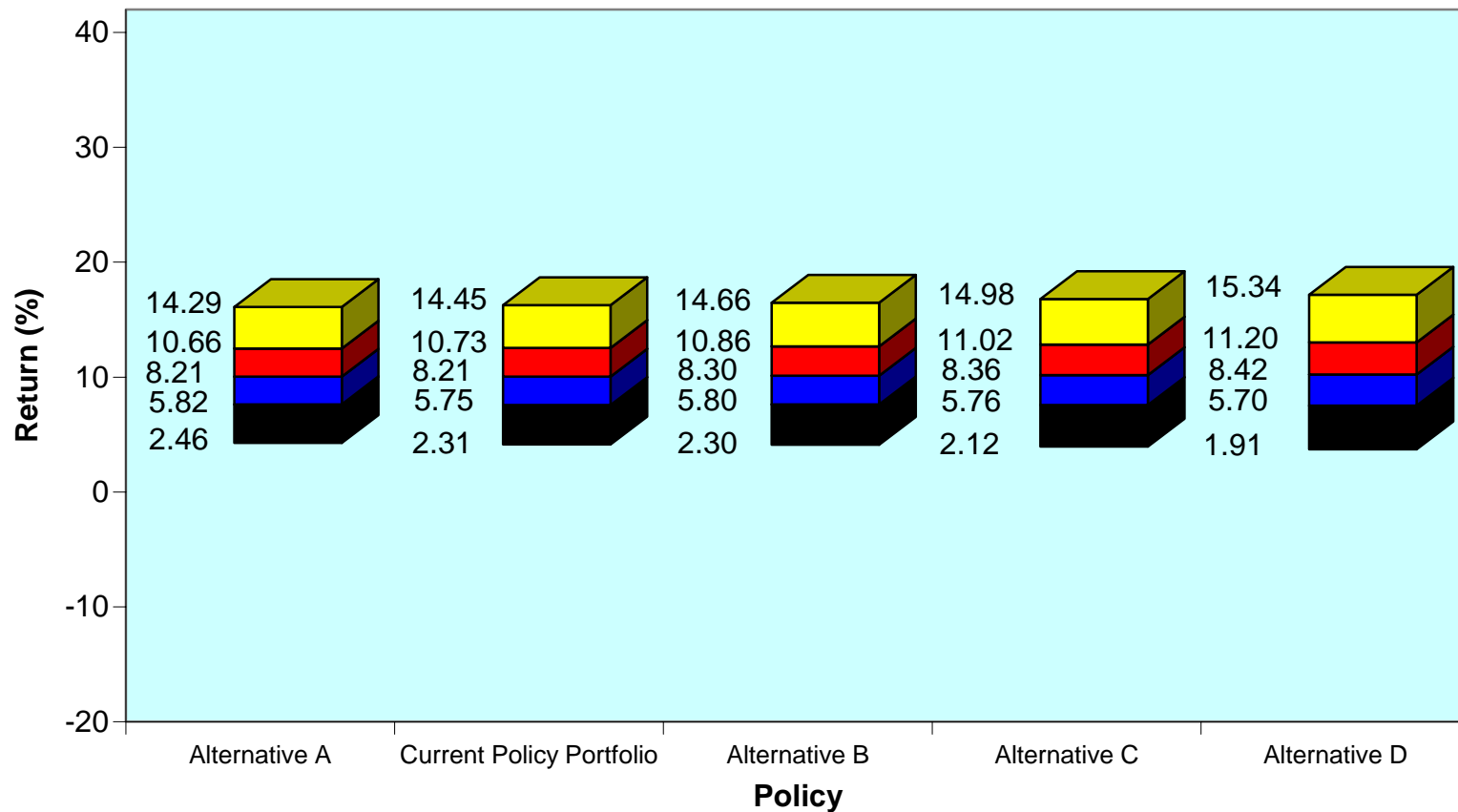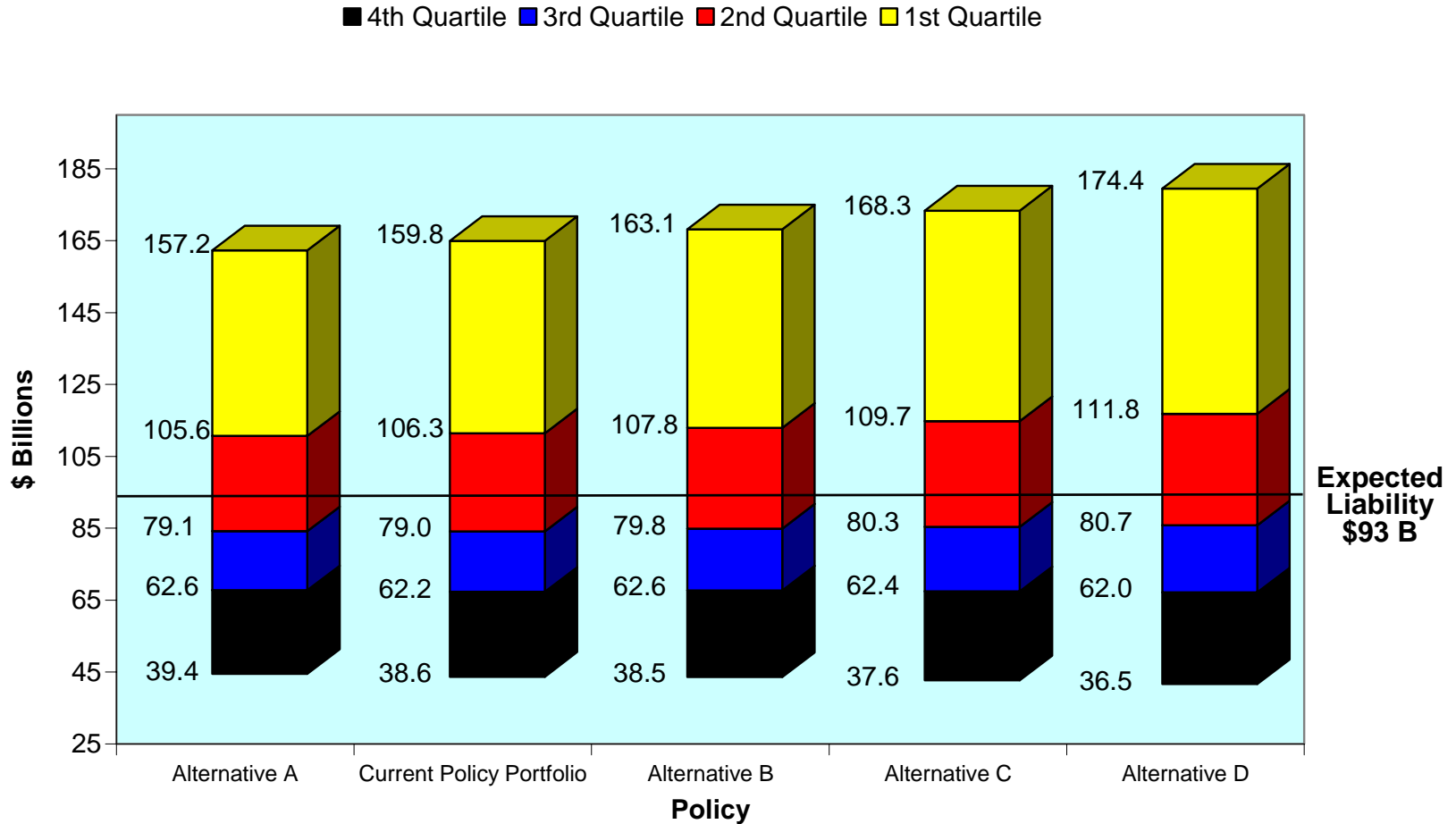
Asset / Liability Analysis

Distribution of Expected Beta Returns *
Year 1

* The returns modeled are "beta" only returns. Should alpha have been modeled, we would anticipate that the expected
   return (alpha plus beta) would reach the actuarial discount rate assumption of 8.50% at the mid-point expected return on
   the bar graph.

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Distribution of Expected Beta Returns *
Year 10

* The returns modeled are "beta" only returns. Should alpha have been modeled, we would anticipate that the expected return (alpha plus beta) would reach the actuarial discount rate assumption of 8.50% at the mid-point expected return on the bar graph.

Asset / Liability Analysis

## Distribution of Expected Market Values
Year 10

Asset / Liability Analysis

Actuarial and Liability Projection Assumptions

- Planning Horizon: 10 Years

- Funding Method: Entry Age Normal

- Start Date: June 30, 2006
    - Market Value of Assets (MVA): $57.3 Billion
    - Actuarial Value of Assets (AVA): $52.6 Billion
    - Current Accrued Liability (AL): $64.7 Billion
    - Unfunded Liability (AL-MVA): $12.2 Billion
    - Payroll: $11.5 Billion

- Actuarial Discount Rate Assumption: 8.50%

- Workforce Growth Rate: 0.00%

- Initial Employee Contribution Rate as a Percent of Payroll: 7.25%

- No Changes to the Benefit Formula or Benefit Enhancements

Asset / Liability Analysis

Ratio of Expected Market Value of Assets to Accrued Liability
Year 10
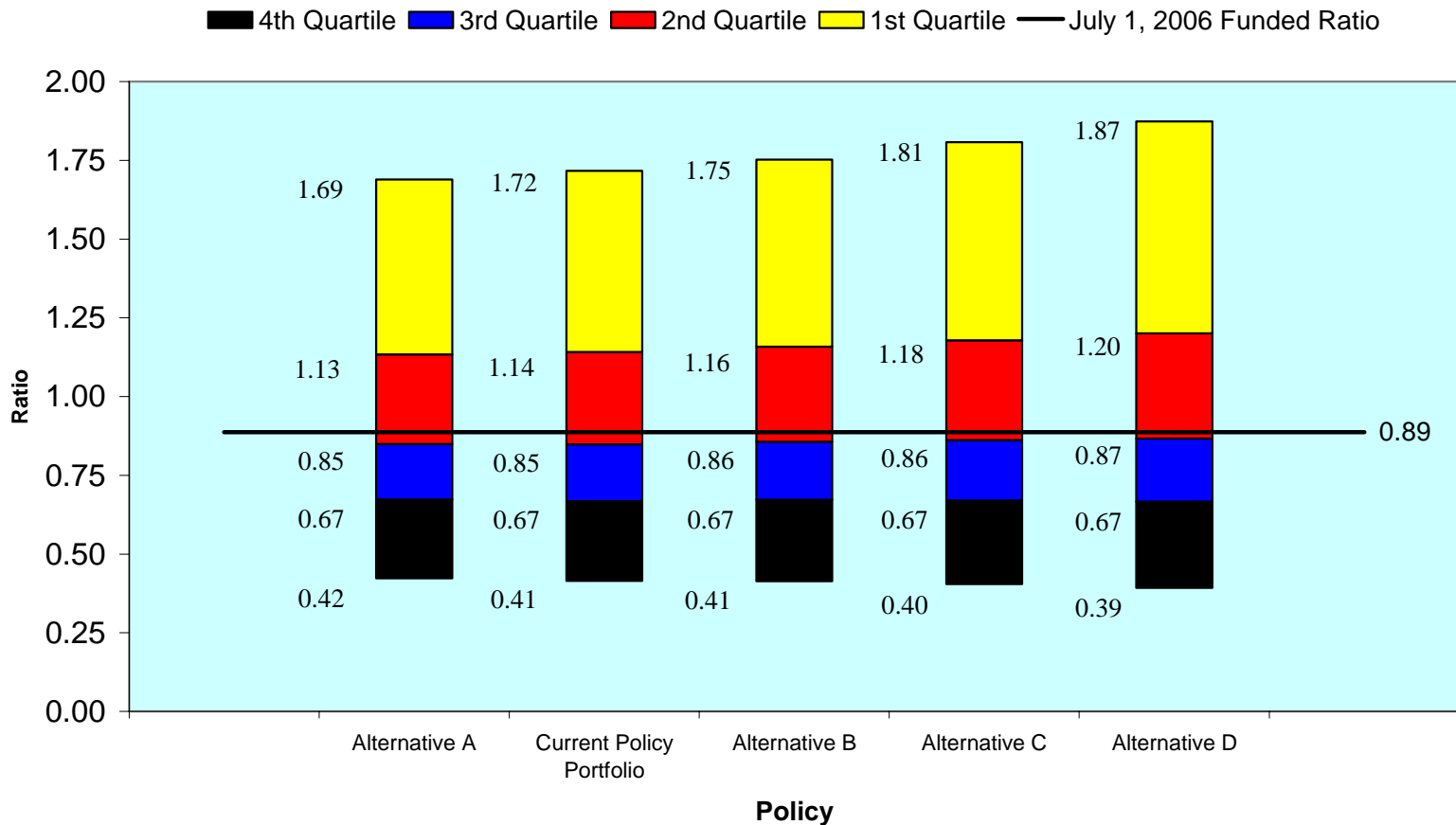
Asset / Liability Analysis

Critical Factors

Plan Characteristics

- Plan liabilities are long-term. The duration of plan liabilities is 13.4 years. Time is an ally to long-term investors.

- Over the next 10 years, the PSERS membership is expected to continue shifting to a mature retirement system with inactive members outnumbering active members as early as next year.

Historical and Current Funded Status

- In 1992, PSERS funded status was 87%. By 1996, PSERS achieved fully funded status, both in market value and actuarial value terms.

- Funded surplus peaked in 2000 (135% on a market value basis / 123% on an actuarial value basis).

- Since 2000, the combination of capital market conditions, a drop in contribution rates, and benefit enhancements have reduced the funded status. PSERS is currently in an under funded position (89% of market value). Over the last fiscal year, the market value increased by $5 billion ($57.3 vs $52.3) as liabilities increased by $3.5 billion ($64.7 vs $61.2).

Asset / Liability Analysis

Critical Factors

Contributions – Historical and Current

- In 1993, the employer contribution rate was approximately 13% of payroll, this coincided with a funded ratio of 87%.

- As funded status improved during the 1990's, employer contributions as a percent of payroll fell from 13% to approximately 1% by 2000.

- Based on Act 2003-40, employer contributions are scheduled to increase progressively in future years from 6.5% in fiscal 2007 to 18.7% in fiscal 2013.

Return Expectations

- Based on current market expectations, the expected return on assets (beta only) is not projected to meet the actuarial return assumption (8.21% vs 8.50%). *

- The difference of 29 basis points between the return expectations (beta) and the discount rate represents approximately $166 million or approximately 1.4% of payroll. *

* The 29 basis point annual difference excludes the anticipated "alpha" from active management. Should alpha have been modeled, we would anticipate that the expected return (alpha plus beta) would reach the actuarial discount rate assumption of 8.50%.

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Conclusions

- Capital market opportunities are not expected to provide sufficient returns to improve the funded condition.

    - Additional contributions are required to close the gap in projected assets versus liabilities.

- PSERS Investment Staff and Wilshire recommend that the PSERS Board approve the following:

    - An increase in the total real estate allocation to 8% from 7% (to be funded from public equities)

    - An increase to the size of the Acorn S&P 500 account to $1.5 billion notional from $500 million notional

    - The conversion of the value-added (alpha) portion of the Bridgewater TIPS account to the more-diversified Pure Alpha product

    - The utilization of the BGI Global Alpha product in the fixed income portfolio to add a diversified source of alpha in this composite

- Wilshire recommends that PSERS maintain a broadly diversified investment approach, continue to identify diversified sources of value added investment opportunities and fill in structural gaps on an as-needed and opportunistic basis.

Tab 3

Independent Fiduciary Services, Inc. Recommendations

Independent Fiduciary Services, Inc. Recommendations

Wilshire Responses

- IIA-8: Consider designating an asset allocation index as an additional total fund benchmark in the IPS.

  ▪ The quarterly attribution report provided by Wilshire and PSERS staff provides the same information that an "asset allocation index" would provide. That is, it attributes performance variances to structural differences in the composites, allocation drifts, and underlying manager performance. Therefore, Wilshire does not recommend the construction of an additional policy benchmark.

- IIB-2: Reconsider and discuss the capital market assumptions used for real estate with the investment consultant.

  ▪ Wilshire develops its capital market and asset class expectations annually, using forward-looking expectations for return, risk and correlation. Wilshire has separate assumptions for both public (REIT) real estate and private real estate. In the future, Wilshire will utilize the separate assumptions in the appropriate mix to optimally estimate the return and risk profile for the real estate allocations. (This recommendation has been implemented in the current Asset / Liability Analysis.)

Independent Fiduciary Services, Inc. Recommendations

Wilshire Responses

- IIE-1: PSERS should consider measuring the international equity portfolio against the S&P/Citigroup BMI Global Index ex-US.

  - Given the new investments in the small capitalization non-US equity markets, we believe it is prudent to identify a benchmark reflecting these exposures. While the S&P / Citigroup BMI Index would achieve this, it is a lightly-followed index, with little exposure and limited use by institutional investment managers. The MSCI series is an institutionally-accepted benchmark.

  - Moreover, in a release dated January 18, 2007, MSCI Barra outlined changes to its existing benchmarks that will begin June 30, 2007 in order to gain a broader measure of non-US markets. On June 30, MSCI Barra will begin a transition (to be completed over the following 12 months) to provide an "investable market index" which will track nearly all investable securities in the developed and emerging markets. It is Wilshire's recommendation that PSERS utilize this broader benchmark from MSCI Barra for the non-US equity composite, as it becomes available in the near future.

- IIE-2: PSERS should consider measuring the fixed income portfolio against the Lehman Brothers US Universal Index.

  - Wilshire agrees with the recommendation to utilize the Lehman Brothers US Universal Index as the US fixed income composite benchmark. The primary difference between this benchmark and the Lehman Aggregate Index is the inclusion of high yield bonds, which is also a component of the PSERS composite. In the past, the PSERS fixed income composite would have had lower tracking error to the Universal Index.

- IIE-3: PSERS should consider using a broader global index such as the Lehman Brothers Multiverse Index.

  - Wilshire agrees with the recommendation to utilize the Lehman Brothers Multiverse Index as the benchmark for the global fixed income composite. The Lehman Multiverse Index includes exposure to a broader set of global fixed income, particularly high yield exposure, which is consistent with the investments of PSERS global fixed income composite.

Appendix

The Mathematics of Asset / Liability Valuation
Portfolio Optimization Constraints

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The Mathematics of Asset / Liability Valuation

Inadequate long term asset returns should be a concern of any pension plan. We need a tool to measure how it affects a plan's abilities to pay promised benefits. With apologies, a bit of math will be involved...

- Assume you know for certain that you will have to pay exactly $100 a year from now. Further assume you know that your investments will earn exactly 3% during the year. You then can calculate exactly how much you need to have invested today to pay that $100 a year from now using the following equation:

$$Required\ Assets * 1.03 = \$100$$

- Dividing Both sides by 1.03 solves for Required Assets

$$Required\ Assets = \$100/1.03 = \$97.09$$

Outside of U.S. Treasuries, none of us know exactly how much any investment will earn in the future. Investing involves risk. Since funding a pension plan involves paying benefits over an extended period of time out of these assets, our goal should be be to minimize the cost of providing those benefits and maximizing their safety.

The Mathematics of Asset / Liability Valuation

- Let

$$B_1, B_2, ..., B_{100}$$

be the benefits the System will pay, over the next 100 years. Provided by the actuary, it is a point estimate of the pension commitment.

- The benefits include the actuary's estimates of wage and price inflation. Since future inflation is unknown, let

$$I_1, I_2, ..., I_{100}$$

represent that uncertainty over each of the next 100 years. The actual benefits paid will then be

$$B_1(1+I_1), B_2(1+I_1)(1+I_2), ..., B_{100}(1+I_1)(1+I_2)...(1+I_{100})$$

This series of promised benefits is the true liability of the system.

The Mathematics of Asset / Liability Valuation

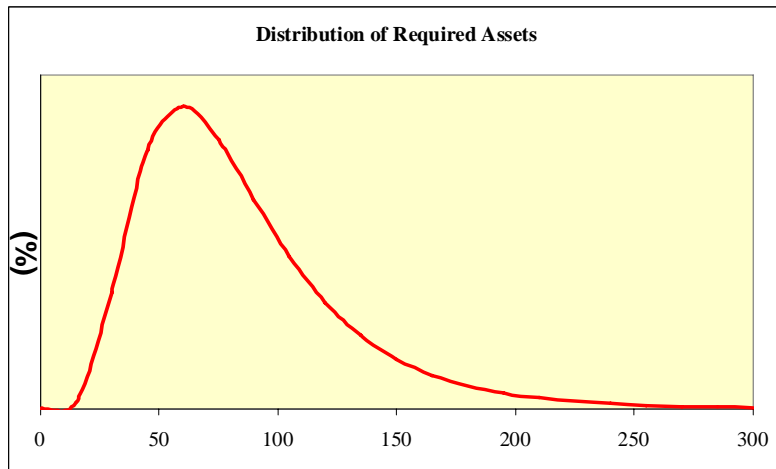- Future asset returns in each year:

$$R_1, R_2, ..., R_{100}$$

are also unknown.

- Extending our equation of required assets to include multiple payments yields

$$\text{Required Assets} = \frac{B_1(1+I_1)}{(1+R_1)} + \frac{B_2(1+I_1)(1+I_2)}{(1+R_1)(1+R_2)} + ... + \frac{B_{100}(1+I_1)(1+I_2)...(1+I_{100})}{(1+R_1)(1+R_2)...(1+R_{100})}$$

Distribution of Required Assets

Rather than a fixed number, Required Assets has a distribution. We can minimize its expected value (cost), and its standard deviation (risk).

Asset Allocation Process

Portfolio Optimization
Asset Class Constraints

	Minimum	Maximum
US Equity	0%	40%
Non-US Equity *	0%	40%
US Core Fixed Income	5%	20%
High Yield Fixed Income	0%	5%
TIPS	0%	5%
Global Fixed Income **	0%	20%
Private Real Estate	0%	10%
REITs	0%	10%
Private Markets	0%	11%
Commodities	5%	10%

* 30% Hedged / Not Greater Than US Equity
** Not Greater Than ½ of US Core Fixed Income

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