SPRINGFIELD POLICE OFFICERS & FIREFIGHTERS PENSION PLAN

Investment Strategy Study

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March 2009

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Efficient Frontier: Return/Standard Deviation Assumptions

Asset Category	Return	Standard Deviation
Large Cap Equity	9.00	18.00
Smid Cap Equity	9.50	18.75
International Equity	9.62	19.95
Domestic Fixed Income	4.00	5.65
High Yield Bonds	8.30	12.25
International Fixed Income	4.87	10.45
Real Estate	7.37	7.16

New class to consider

EXPECTED RETURN OVER NEXT 10 YR PERIOD

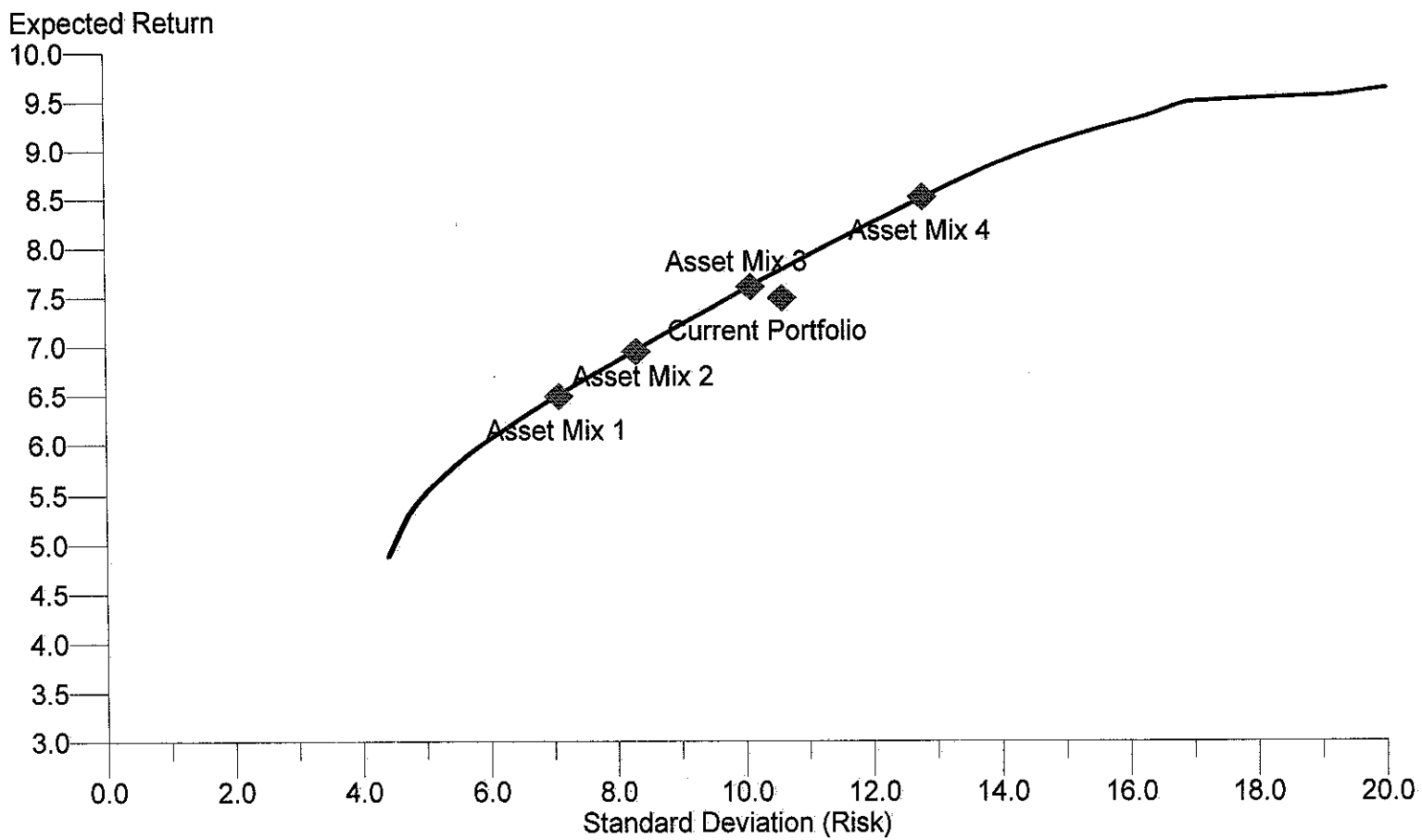
Note: A standard deviation of 18.00% means that on average in 2 of every 3 years the returns on Domestic Large Cap Equity stocks will range between -9.00% and 27.00% (i.e., the expected return of 9.00% ± 18.00%).

Efficient Frontier: Asset Correlation Coefficients

	Large Cap Equity	Smid Cap Equity	International Equity	Domestic Fixed Income	High Yield Bonds	International Fixed Income	Real Estate
Large Cap Equity	1.00						
Smid Cap Equity	0.79	1.00					
International Equity	0.64	0.62	1.00				
Domestic Fixed Income	0.16	0.16	-0.28	1.00			
High Yield Bonds	0.63	0.87	0.47	0.32	1.00		
International Fixed Income	0.13	0.05	0.17	0.43	0.31	1.00	
Real Estate	0.08	-0.15	0.28	-0.38	-0.43	-0.37	1.00

Note: A correlation of +1.00 means that returns under two categories always move in the same direction while -1.00 means they always move in opposite directions. If the correlation is 0.00 there is no relationship between the two. Correlation is based on historical performance.

Efficient Frontier

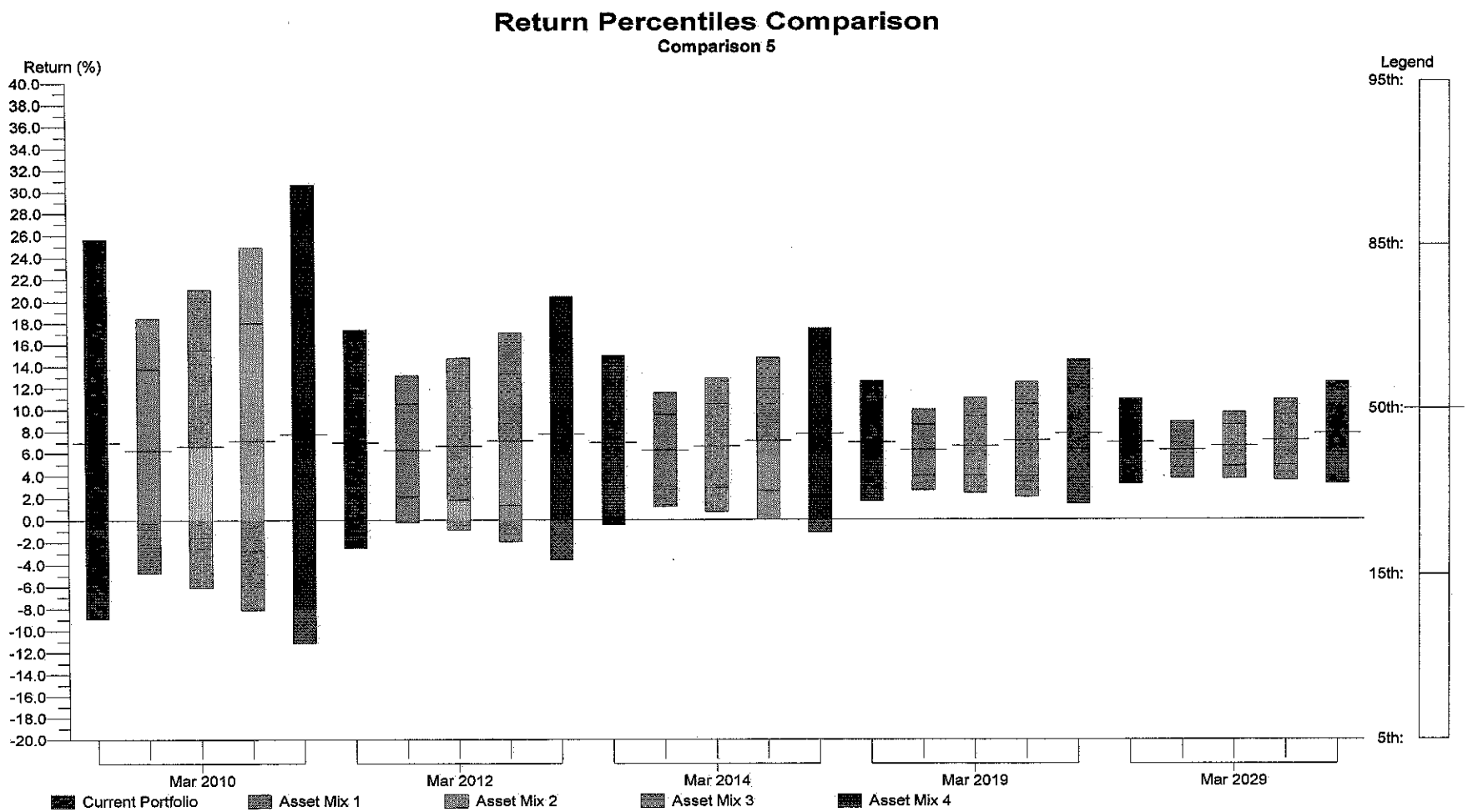


Asset Allocation Scenarios

	Current Policy	Asset Mix 1	Asset Mix 2	Asset Mix 3	Asset Mix 4
Large Cap Equity	36.00	7.00	10.00	14.00	20.00
Smid Cap Equity	4.00 ?	7.00	11.00	16.00	23.00
International Equity	20.00 ?	15.00	16.00	20.00	25.00
Domestic Fixed Income	21.75	35.00	23.00	14.00	4.00
High Yield Bonds	0.00	12.00	12.00	12.00	12.00
International Fixed Income	10.75	17.00	21.00	17.00	9.00
Real Estate	7.50	7.00	7.00	7.00	7.00
Expected Return	7.49	6.48	6.94	7.60	8.50
Standard Deviation	10.54	7.07	8.28	10.07	12.75
Sharpe Ratio Risk Ajusted Return	0.38	0.42	0.42	0.41	0.39

NOTE: These portfolios were developed using return/risk assumptions and correlation coefficients. A Sharpe ratio is a risk-adjusted measure calculated using standard deviation and excess return to determine reward per unit of risk. The higher the Sharpe ratio, the better the risk-adjusted performance.

Asset Allocation Scenarios



Return Percentiles

Return Percentiles: 1 Year

Percentile	Current Policy	Asset Mix 1	Asset Mix 2	Asset Mix 3	Asset Mix 4
95th Percentile	25.65	18.48	21.07	24.93	30.65
85th Percentile	18.39	13.80	15.51	18.02	21.66
50th Percentile	6.98	6.24	6.62	7.13	7.76
15th Percentile	-3.34	-0.81	-1.59	-2.75	-4.56
5th Percentile	-8.92	-4.73	-6.11	-8.12	-11.12

Return Percentiles: 5 Years

Percentile	Current Policy	Asset Mix 1	Asset Mix 2	Asset Mix 3	Asset Mix 4
95th Percentile	14.96	11.55	12.86	14.75	17.45
85th Percentile	11.94	9.56	10.51	11.87	13.77
50th Percentile	6.98	6.24	6.62	7.13	7.76
15th Percentile	2.24	3.03	2.87	2.60	2.07
5th Percentile	-0.45	1.19	0.73	0.02	-1.14

Return Percentiles

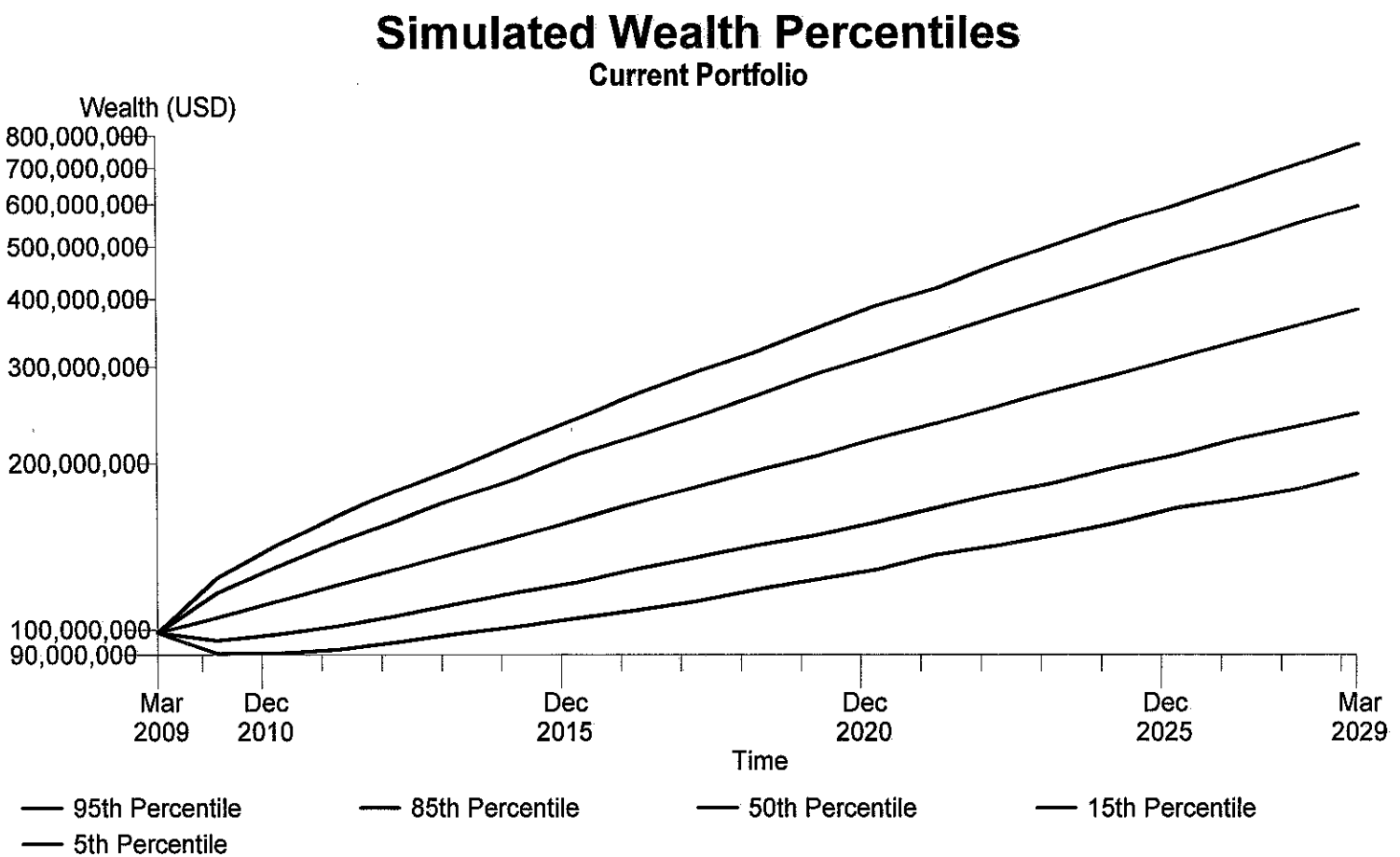
Return Percentiles: 10 Years

Percentile	Current Policy	Asset Mix 1	Asset Mix 2	Asset Mix 3	Asset Mix 4
95th Percentile	12.56	9.97	10.99	12.47	14.52
85th Percentile	10.46	8.58	9.35	10.46	11.97
50th Percentile	6.98	6.24	6.62	7.13	7.76
15th Percentile	3.60	3.96	3.95	3.90	3.70
5th Percentile	1.67	2.64	2.42	2.05	1.39

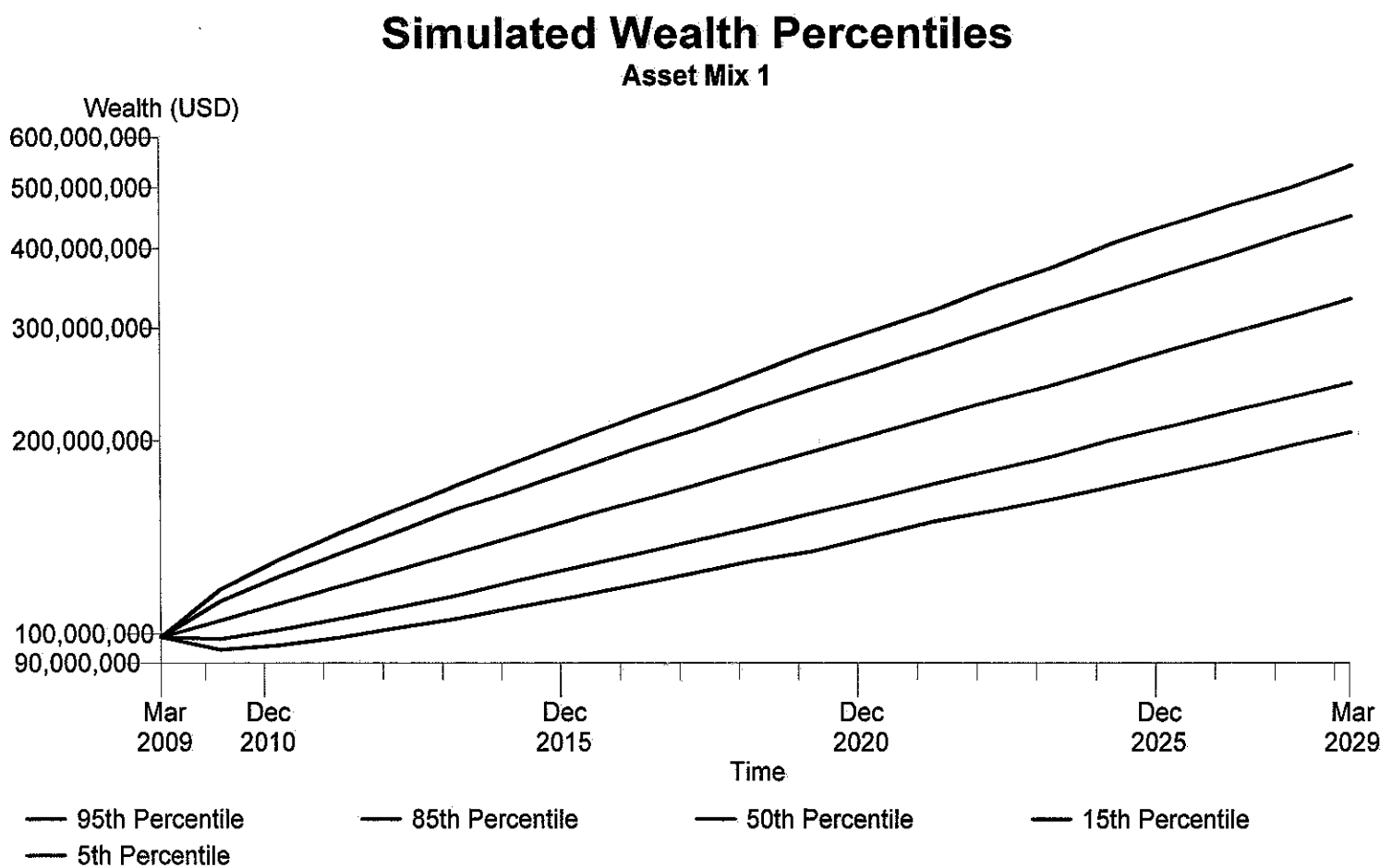
Return Percentiles: 20 Years

Percentile	Current Policy	Asset Mix 1	Asset Mix 2	Asset Mix 3	Asset Mix 4
95th Percentile	10.89	8.87	9.69	10.88	12.50
85th Percentile	9.43	7.89	8.55	9.48	10.72
50th Percentile	6.98	6.24	6.62	7.13	7.76
15th Percentile	4.58	4.62	4.73	4.84	4.87
5th Percentile	3.20	3.68	3.63	3.52	3.22

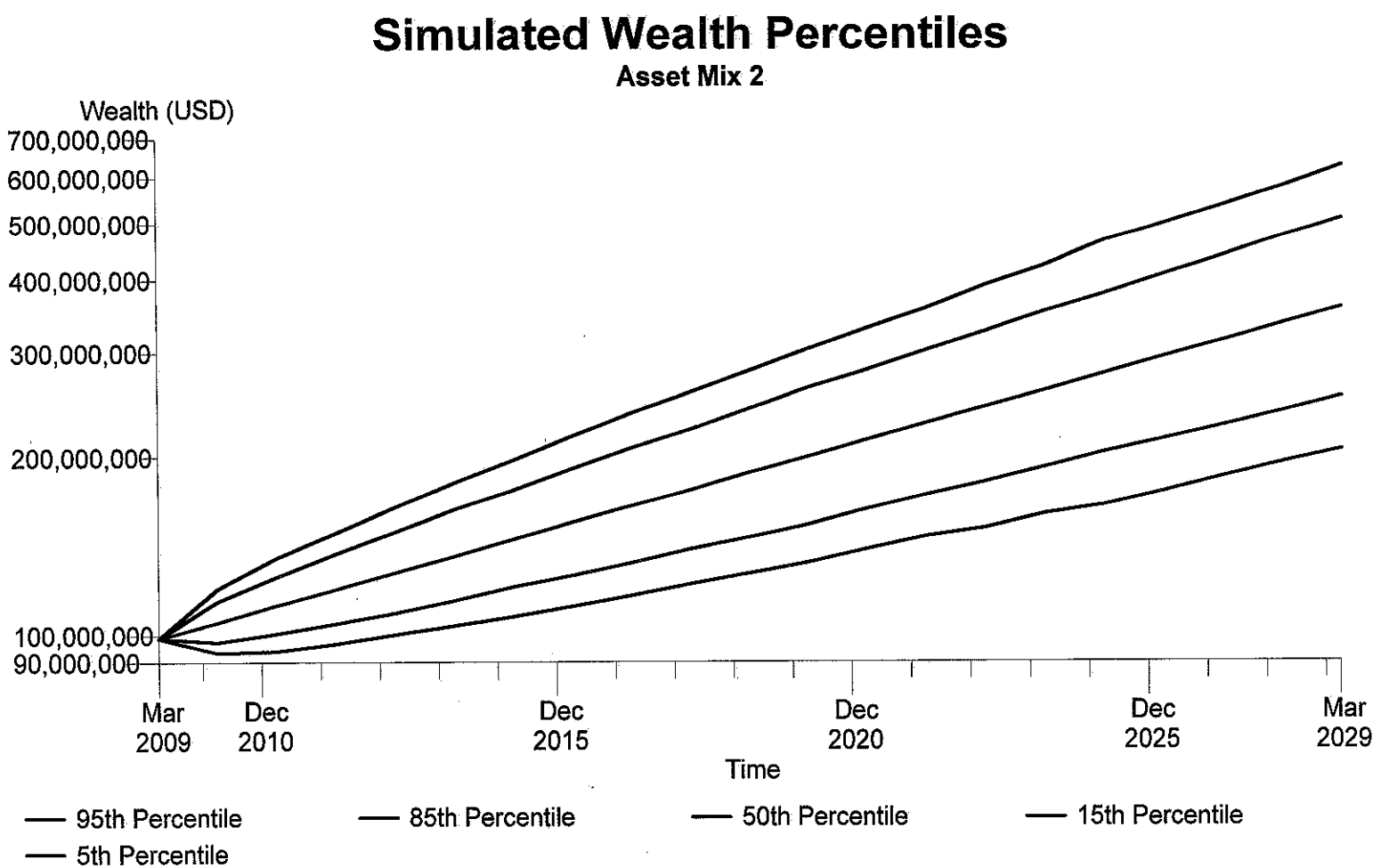
Simulated Wealth Percentiles: Current Allocation



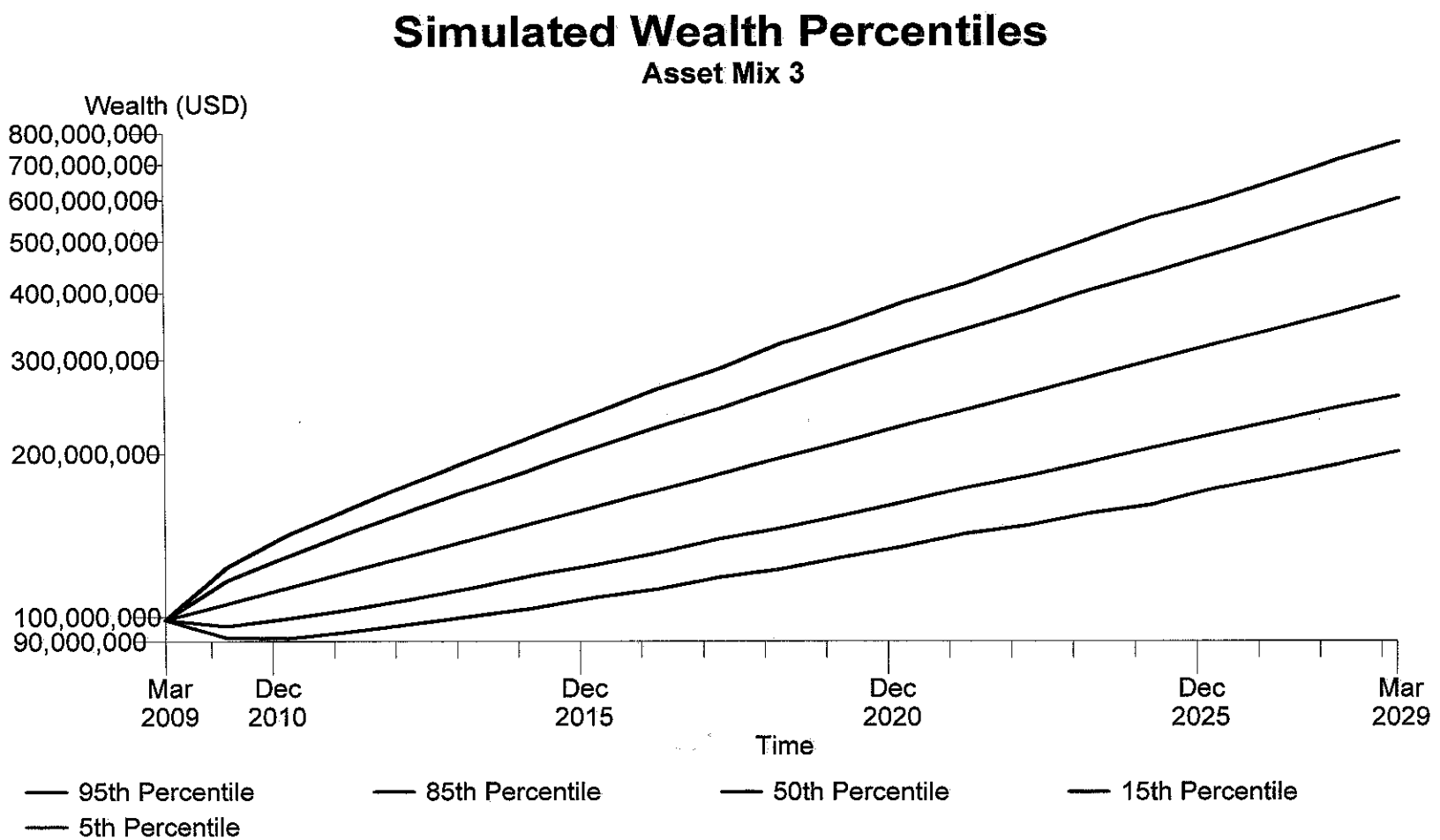
Simulated Wealth Percentiles: Asset Mix 1



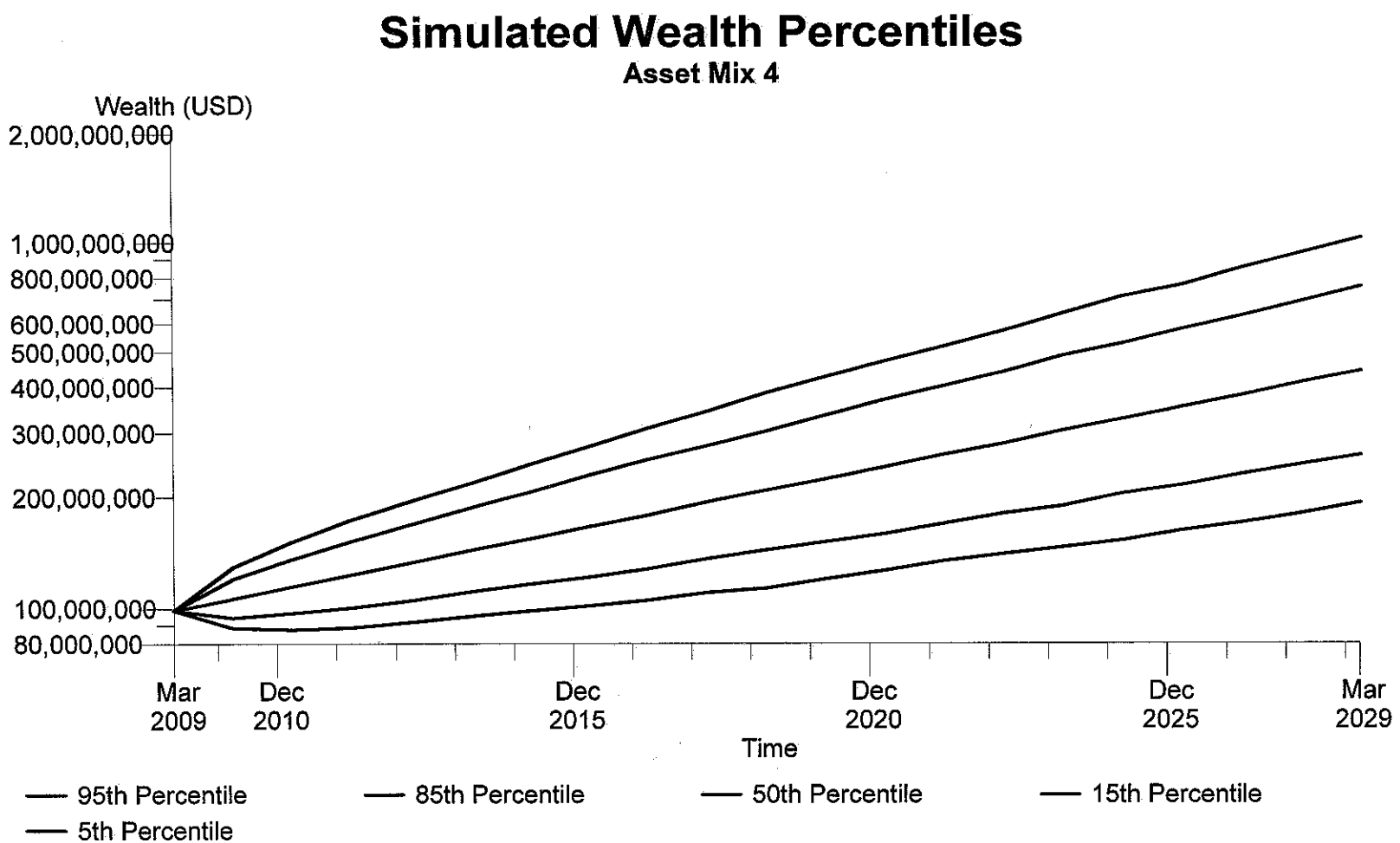
Simulated Wealth Percentiles: Asset Mix 2



Simulated Wealth Percentiles: Asset Mix 3



Simulated Wealth Percentiles: Asset Mix 4



Simulated Wealth Percentiles ($ millions)

Current Policy	1 Year	5 Year	10 Year	20 Year
95th Percentile	124.4	196.1	319.5	770.2
85th Percentile	116.9	172.6	264.9	593.1
50th Percentile	105.4	138.1	193.6	380.9
15th Percentile	95.7	111.5	142.4	246.1
5th Percentile	90.6	98.2	118.4	190.8

Asset Mix 2	1 Year	5 Year	10 Year	20 Year
95th Percentile	119.8	180.5	279.0	624.1
85th Percentile	114.1	162.5	240.4	507.0
50th Percentile	105.1	135.8	187.5	356.0
15th Percentile	97.4	114.3	146.1	251.6
5th Percentile	93.3	103.6	126.9	204.7

Asset Mix 1	1 Year	5 Year	10 Year	20 Year
95th Percentile	117.2	170.3	254.6	540.0
85th Percentile	112.3	156.2	224.6	449.9
50th Percentile	104.9	133.6	181.0	332.1
15th Percentile	98.1	114.7	146.3	246.2
5th Percentile	94.5	105.6	129.9	205.9

Asset Mix 3	1 Year	5 Year	10 Year	20 Year
95th Percentile	123.4	195.2	321.0	768.4
85th Percentile	116.6	172.0	265.4	601.1
50th Percentile	105.7	139.2	196.3	391.1
15th Percentile	96.1	113.2	145.7	255.6
5th Percentile	91.4	100.3	122.3	201.7

The simulated wealth percentiles are based on an initial market value of $98.8 million.

Simulated Wealth Percentiles ($ millions)

Asset Mix 4	1 Year	5 Year	10 Year	20 Year
95th Percentile	129.3	217.8	384.3	1020.9
85th Percentile	120.2	186.9	302.0	750.8
50th Percentile	106.3	143.7	208.2	440.0
15th Percentile	94.3	110.8	143.7	259.6
5th Percentile	88.5	95.0	113.2	192.1