Actuarial Projection Study
of the

STATE EMPLOYEES RETIREMENT FUND

Presented by:

Milliman & Robertson, Inc.
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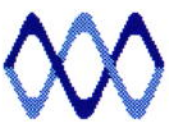
December 22, 1999



Milliman and Robertson, Inc.
Actuaries and Consultants

MILLIMAN & ROBERTSON, INC.
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December 22, 1999

Mr. Lawrence A. Martin
Executive Director
Minnesota Legislative Commission
On Pensions and Retirement
55 State Office Building
St. Paul, Minnesota 55155-1201

RE: Actuarial Projection Study

Dear Larry:

Incorporated within this report are the results of our actuarial asset/liability projection analysis of the State Employees Retirement Fund of the Minnesota State Retirement System. We have relied without audit on the basic employee data and asset figures as submitted by the Minnesota State Retirement System for the July 1, 1998 valuation. To the extent that the employee data and asset figures are incomplete or inaccurate, the results of this study will be changed.

The graphs and tables in Tab II of the report are intended to demonstrate the potential range of results on a probabilistic basis as opposed to the single point estimates of a traditional deterministic actuarial valuation. We believe that these graphs and tables provide an informative picture of the potential variability and associated risk for the System.

In addition to the graphs and tables, we also include a description of the assumptions and methods used to produce the projection results, as well as some interpretive commentary. As is true with any projection, the assumptions used will play a significant role in the final results. If actual experience is different from what is assumed, the results of this study will not match the ultimate results realized by the System.

Copies of this report have been sent in the same quantities as required for our annual valuation. We stand ready to answer any further questions you or other interested parties may have.

Respectfully submitted,

MILLIMAN & ROBERTSON, INC.

Thomas K. Custis, F.S.A.
Consulting Actuary

TKC/bh

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SECTION I: BACKGROUND

A. Scope and Variables

This study arises out of a statutory mandate to complete an analysis which includes a projection of the expected accrued liability funding ratio under the projected unit credit funding method. While such an analysis is included in this report, we decided that a dynamic, stochastic analysis would provide a broader range of information than a traditional deterministic model. The mechanics of the stochastic modeling are discussed in the next section. The general idea of this type of study is to look at the possible range of future outcomes as opposed to determining point estimates based on a fixed set of assumptions.

In addition, we can look at how the potential range of outcomes is affected if other program changes are considered. The specific program variables we explored were:

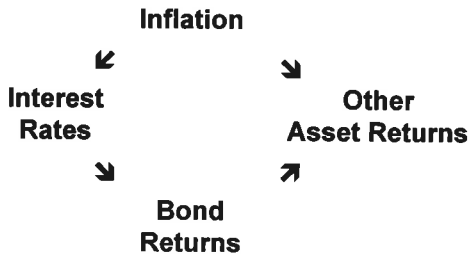
1. Modifications in the funding method and asset valuation method as have been recommended;
2. Declining future active membership; and
3. Reduction in future contribution rates.

B. Asset / Liability Projection Methodology

The asset/liability model projects the financial status of the retirement system for each of the next several years. As opposed to an actuarial valuation, which is a projection of assets and liabilities based on a single set of actuarial assumptions as of some specified date, an asset/liability study provides additional dimensions by introducing a time element and a probabilistic element.

The economic environment and capital markets are projected forward one year at a time. At the end of each year, the model reflects the effect of current economic conditions on an actuarial valuation (e.g., contributions and liabilities, etc.). We will use the term projection assumptions to indicate those assumptions that are used to project from one valuation date to the next, and the term valuation assumptions to indicate those assumptions that are applicable at that valuation date.

Each year the model generates returns for each asset class. These returns are correlated with the other economic variables, such as changes in interest rates and inflation. All of the economic and capital market variables are stochastic, meaning they are described by a probability distribution. For each asset class and inflation, the mean and standard deviation of the annual rate of return are inputs. The model also requires the correlation coefficients between each pair of asset classes, as well as between each asset class and inflation.



The model first generates the rate of inflation, which is assumed to be independent from all the other variables. Then it generates key interest rates which are assumed to be correlated with inflation and each other. All other asset class returns are generated such that they correlate appropriately with inflation, the key interest rate changes and each other. Each variable also exhibits its own randomness, as defined by its standard deviation. This hierarchical structure allows us to examine a plan along particular economic paths, such as high inflation or high interest rates, while still allowing for the random nature of investment returns.

One thousand iterations of the model are generated. Each iteration produces one possible multiple-year projection. All the iterations are assumed to be equally likely. For each year, liabilities and assets are tracked to produce distributions of possible outcomes. The results are presented as a range of possible outcomes along with the likelihood of each outcome. By comparing the ranges of outcomes for these key plan obligations, the model provides information about potential variability, thus demonstrating the "risk" associated with various changes.

In determining costs to be incurred by a pension plan in future years, it is necessary to provide valuation assumptions relating to future events beyond the projection date. These valuation assumptions may be classified into three different categories.

The ***first category*** involves the economic assumptions. These assumptions include assumed investment return, salary increases, social security increases and cost-of-living increases on plan benefits. These assumptions are characterized as economic because they generally tend to be affected by interrelated factors which also affect economic growth.

The ***second category*** relates to demographic assumptions which affect the expected working lifetime (and retired lifetime) of a member and the number of members covered by the system. These assumptions include mortality rates, disability rates, rates of separation due to other causes, and rates of population change over time.

The ***third category*** relates to miscellaneous assumptions which are needed to accommodate special plan provisions which are not adequately covered in the first two categories. These assumptions would include (but are not limited to) items such as assumed family composition, plan expenses, election to specific benefit forms, etc. These assumptions need to be monitored so that they remain consistent with the plan provisions which are in effect.

C. Projection Assumptions

Capital Market Assumptions

These are the basic economic assumptions which underlie the projection of fund assets. Furthermore, the fund liabilities are adjusted to reflect the difference between projected inflation and the basic inflation component of the salary scale. The Capital Market Assumptions, which are specified in Table 1, provide the basis for creating a reasonable distribution of possible future experience.

Current Member Data Projection

Starting from the July 1, 1998 actuarial valuation data, the census data is projected according to the recommended assumptions with two exceptions. The first exception is that the mortality experience of members is assumed to improve annually over the course of the projection according to Scale H. The second exception is that the expected salary is adjusted to reflect the actual inflation that occurs between July 1, 1998 and the valuation date.

New Entrant Data Projection

At each future valuation date, the projected employee count is determined according to the population growth assumption. The population growth assumption is (a) active member population remains level throughout the 25-year study period or (b) active member population declines 1% each year over the period.

The projected employee count is compared to the number of employees who are projected to remain as active employees at the valuation date. New employees are assumed to be hired each year to bring the total employee count to the projected employee count. The new entrants are assumed to have the composition as displayed in the new entrant profile in Table 2. Finally, the salary of the new entrant profile is adjusted to reflect the actual inflation that occurs between July 1, 1998 and the valuation date. All assumptions other than mortality and economic assumptions are assumed to remain unchanged from July 1, 1998 forward.

Valuation Assumptions

The July 1, 1998 actuarial valuation for purposes of the projection study is based on the package of assumptions recommended for adoption effective July 1, 2000. All of these assumptions are used for each valuation until a 4 year experience review is completed and new assumptions are adopted. New assumptions are assumed to be adopted for valuations in years 2002, 2006, 2010, 2014, 2018, and 2022. The only new demographic assumptions included in the model are a revised mortality table that has 4 years of mortality improvement; all other demographic and miscellaneous assumptions remain unchanged after July 1, 1998.

CAPITAL MARKET ASSUMPTIONS								
	1	2	3	4	5	6	7	8
	Inflation	***Intermediate Bond***	***US Fixed***	***US Stock***	***International Stock***	***Alternative Assets (Basic Fund)***	***Alternative Assets (Post Fund)***	***Cash***
Mean	2.50%	5.79%	5.75%	10.00%	10.00%	9.00%	7.75%	4.00%
Standard Deviation	1.75	7.25	7.75	18.25	20.75	14.00	11.00	1.25
Serial Correlation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Correlation Coefficients	1.00	-0.24	-0.29	-0.26	-0.28	0.20	-0.30	0.53
		1.00	0.97	0.28	0.22	0.07	0.61	0.10
			1.00	0.38	0.28	0.08	0.70	0.05
				1.00	0.65	0.62	0.59	-0.11
					1.00	0.46	0.44	-0.17
						1.00	0.22	-0.02
							1.00	-0.07
								1.00

MINNESOTA STATE RETIREMENT SYSTEM

(State Employees)

Profile of New Entrants During the 1998-99 Fiscal Year

(Count Per 1,000 Total New Entrants)

Age Range	Male		Female	
	Count	*Salary*	*Count*	*Salary*
Under 25	60	19,000	100	19,000
25-29	90	22,000	140	22,000
30-34	70	24,000	90	22,000
35-39	50	27,000	80	23,000
40-44	50	32,000	70	23,000
45-49	40	30,000	50	24,000
50-54	20	28,000	40	23,000
55-59	10	25,000	20	20,000
60-64	5	23,000	5	15,000
65 and up	5	20,000	5	13,000
Total	**400**		**600**	

SECTION II: OUTPUTS

This section includes several graphs and tables as described below. Throughout this section, we are including results for four projection scenarios:

A. **Projection A** incorporates

1. The recommended actuarial assumptions;
2. Current actuarial methods (modified to use a minimum 5-year period for amortization of positive UAL);
3. All current benefits and contributions; and
4. Assumes constant number of active members throughout the study period.

B. **Projection B** is the same as Projection A except that it incorporates the recommended changes in actuarial methods.

C. **Projection C** is the same as Projection B except that it assumes a 1% per year reduction in active membership.

D. **Projection D** is the same as projection B except that future contribution rates are reduced from 4.0%/4.0% to 3.2%/3.2%.

For each of these scenarios, we have produced three graphs:

1. The projection of the range of the Sufficiency/(Deficiency) measure expressed as a percent of pay.
2. The projection of the ratio of actuarial value of assets to the actuarial accrued liability.
3. The projection of the ratio of the actuarial value of assets to the projected accrued benefit liability; i.e., the projected unit credit funding ratio.

The tables provide comparison of scenario to scenario.

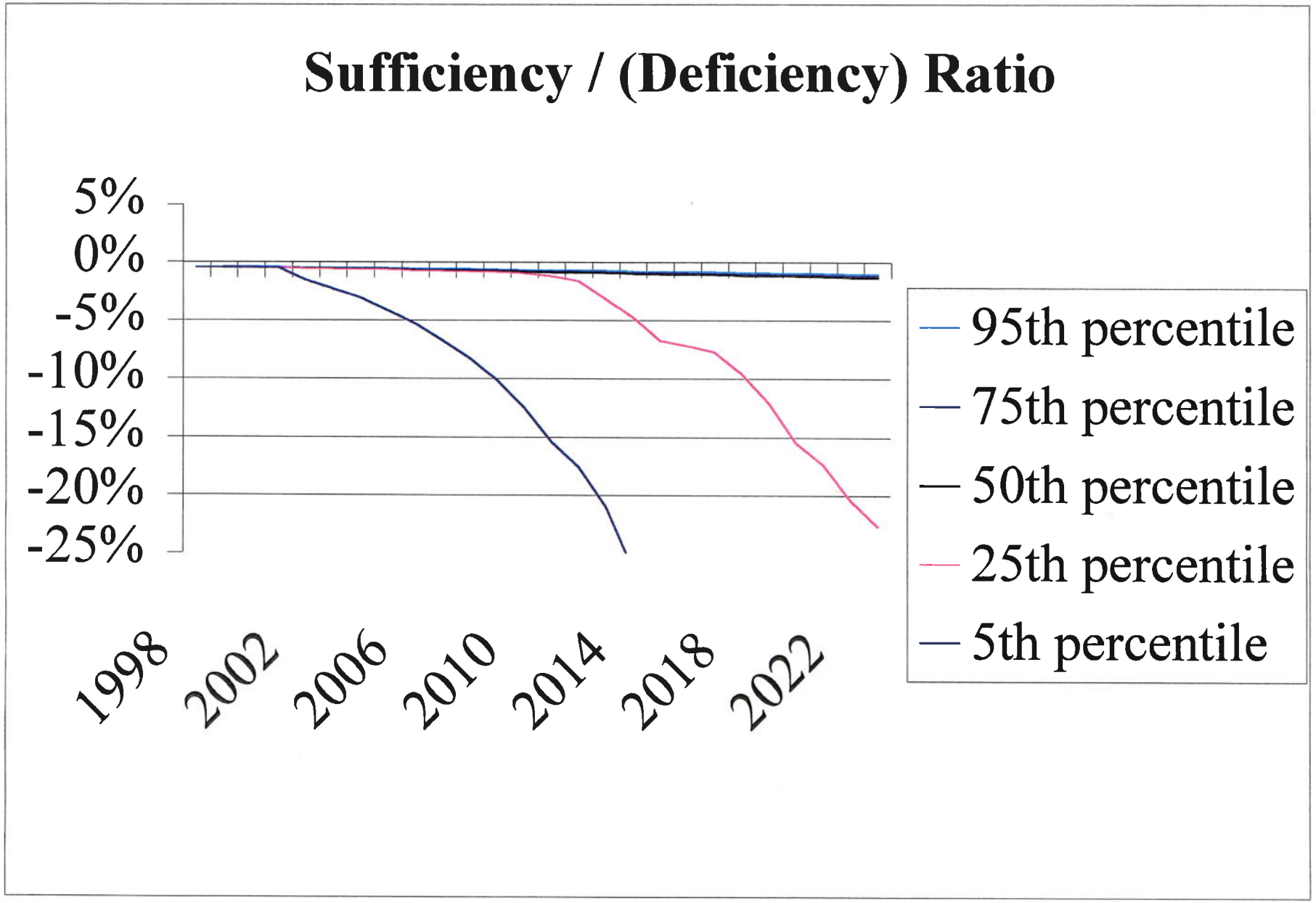
TABLE 3 shows the expected value in each year of the projection study for the projected accrued benefit funding ratio for each of the four scenarios. For this table, "expected value" means the results that would be obtained if the mean value economic assumptions were realized in every year.

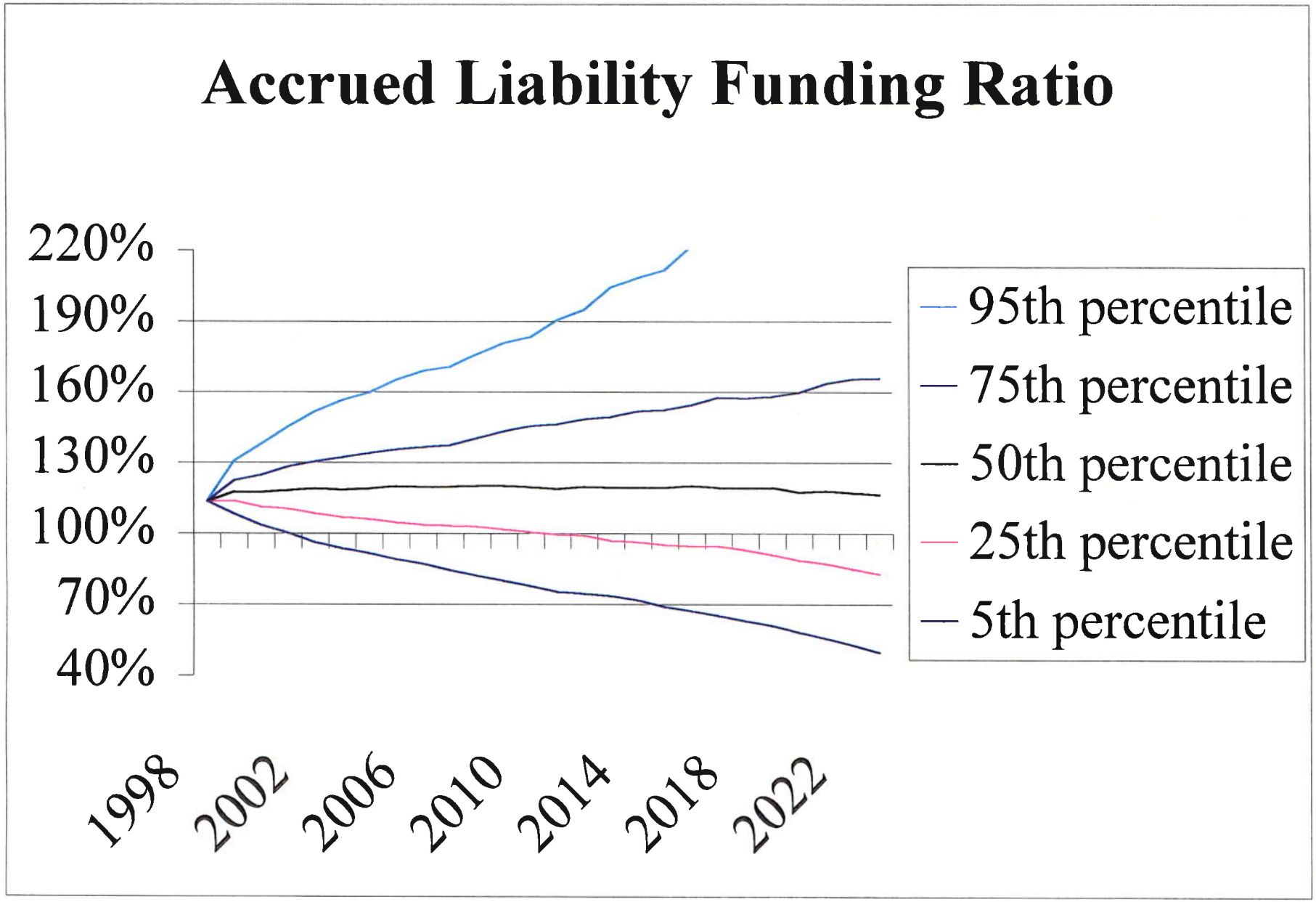
TABLE 4 shows the median value in each year of the projection study for the projected Sufficiency/(Deficiency) Measure for each of the four scenarios. The "median value" represents the point in the range where exactly one-half of the results are higher and one-half of the results are lower.

TABLE 5 shows the median values of the accrued liability funding ratio.

TABLE 6 shows for each scenario the probability that in any given year of the projection that projected actuarial accrued liability will exceed the actuarial value of assets.

TABLE 7 shows for each scenario the probability that at any point up to and including the valuation date in the year of projection the plan has or has had an unfunded liability.


Sufficiency / (Deficiency) Ratio
5%
0%
-5%
-10%
-15%
-20%
-25%
1998
2002
2006
2010
2014
2018
2022
95th percentile
75th percentile
50th percentile
25th percentile
5th percentile


Accrued Liability Funding Ratio
220%
190%
160%
130%
100%
70%
40%
1998
2002
2006
2010
2014
2018
2022
95th percentile
75th percentile
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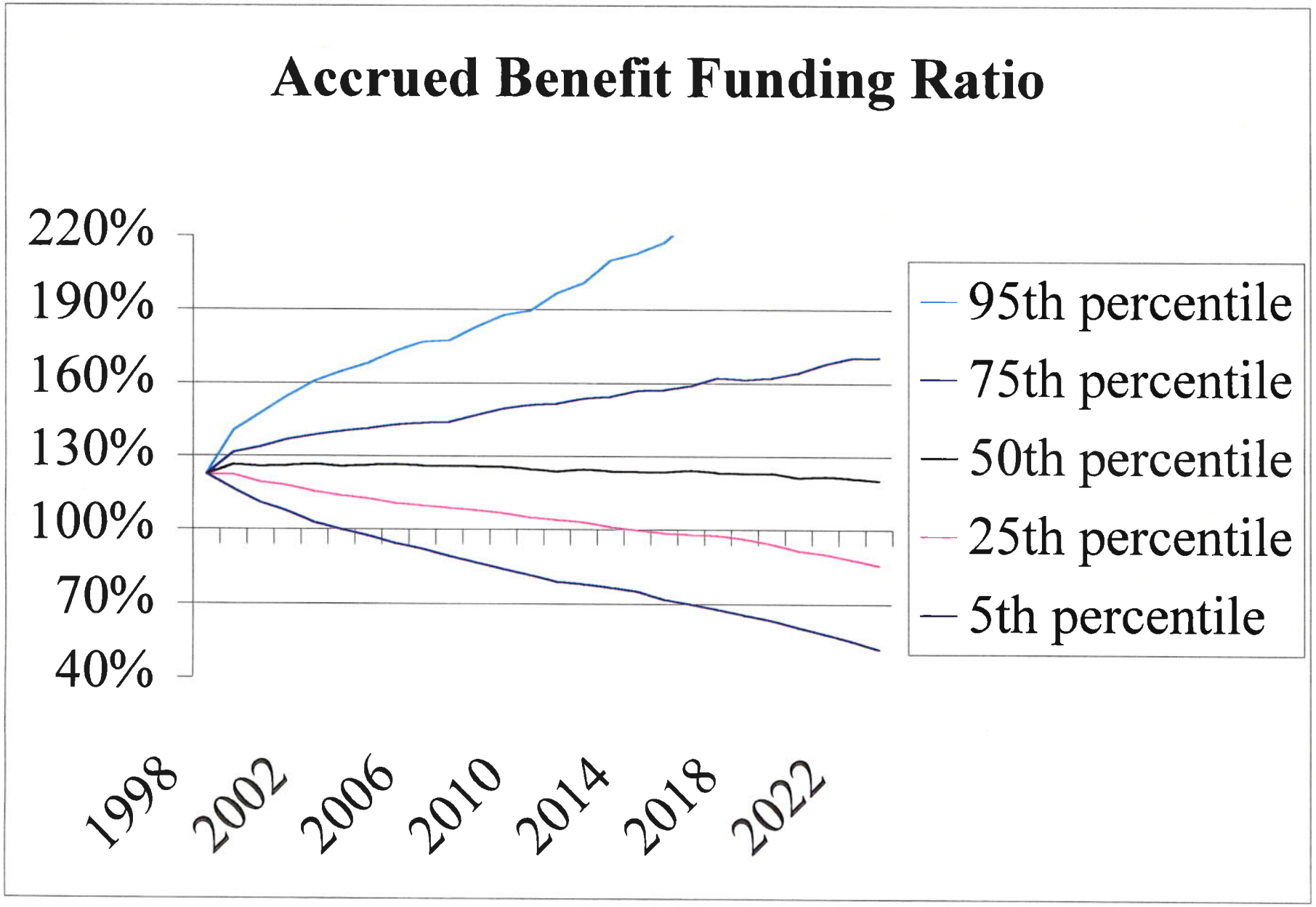
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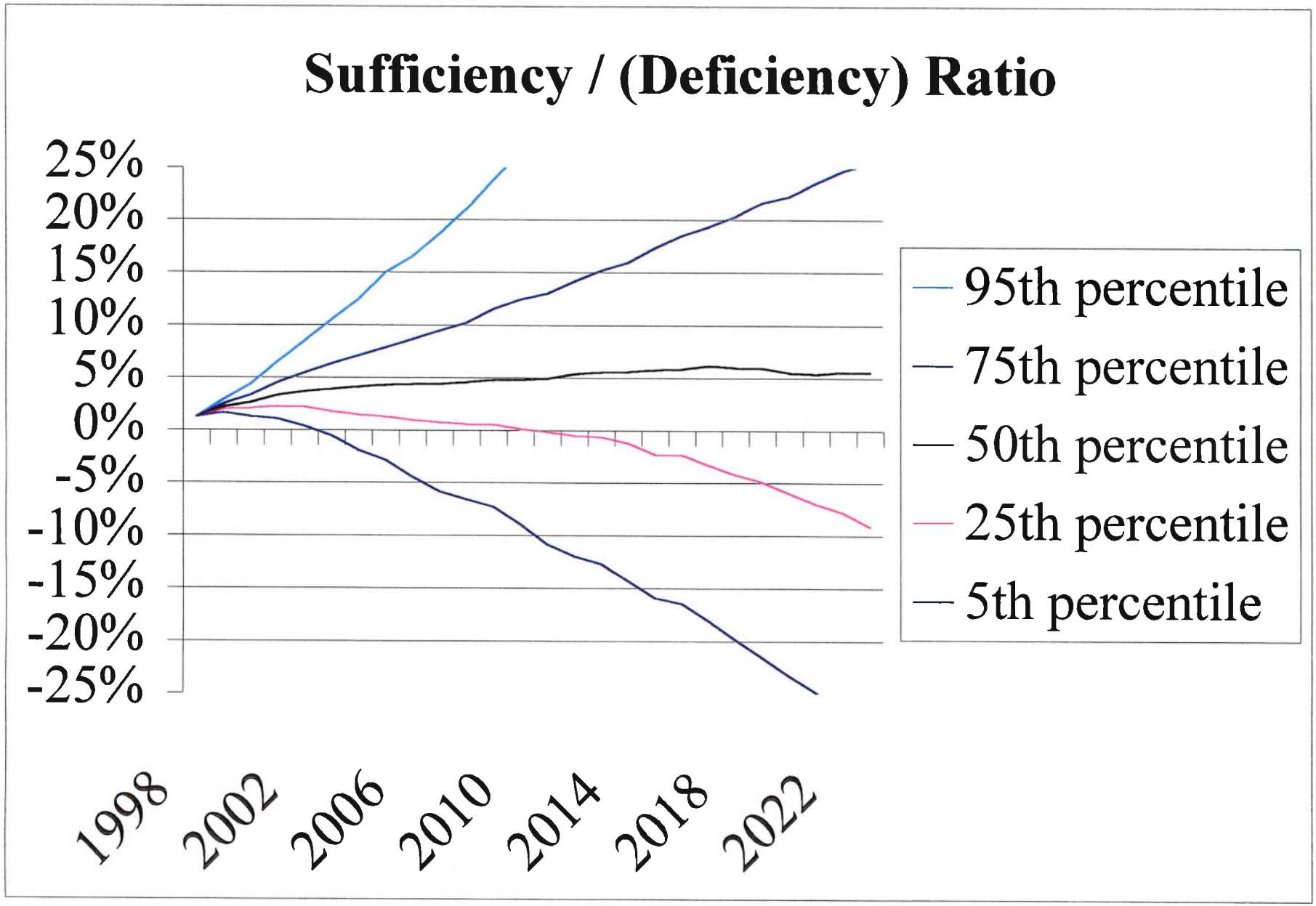
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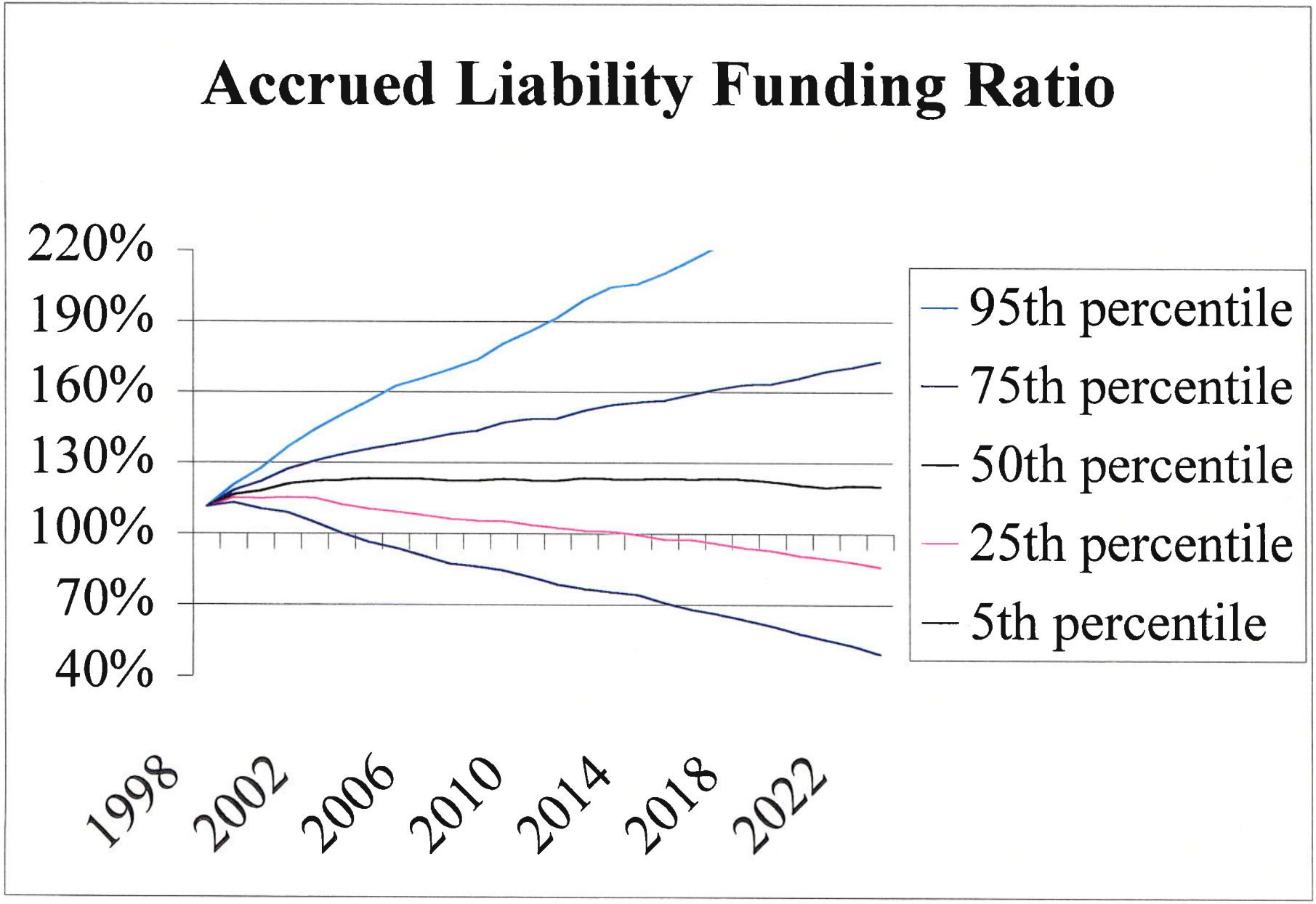
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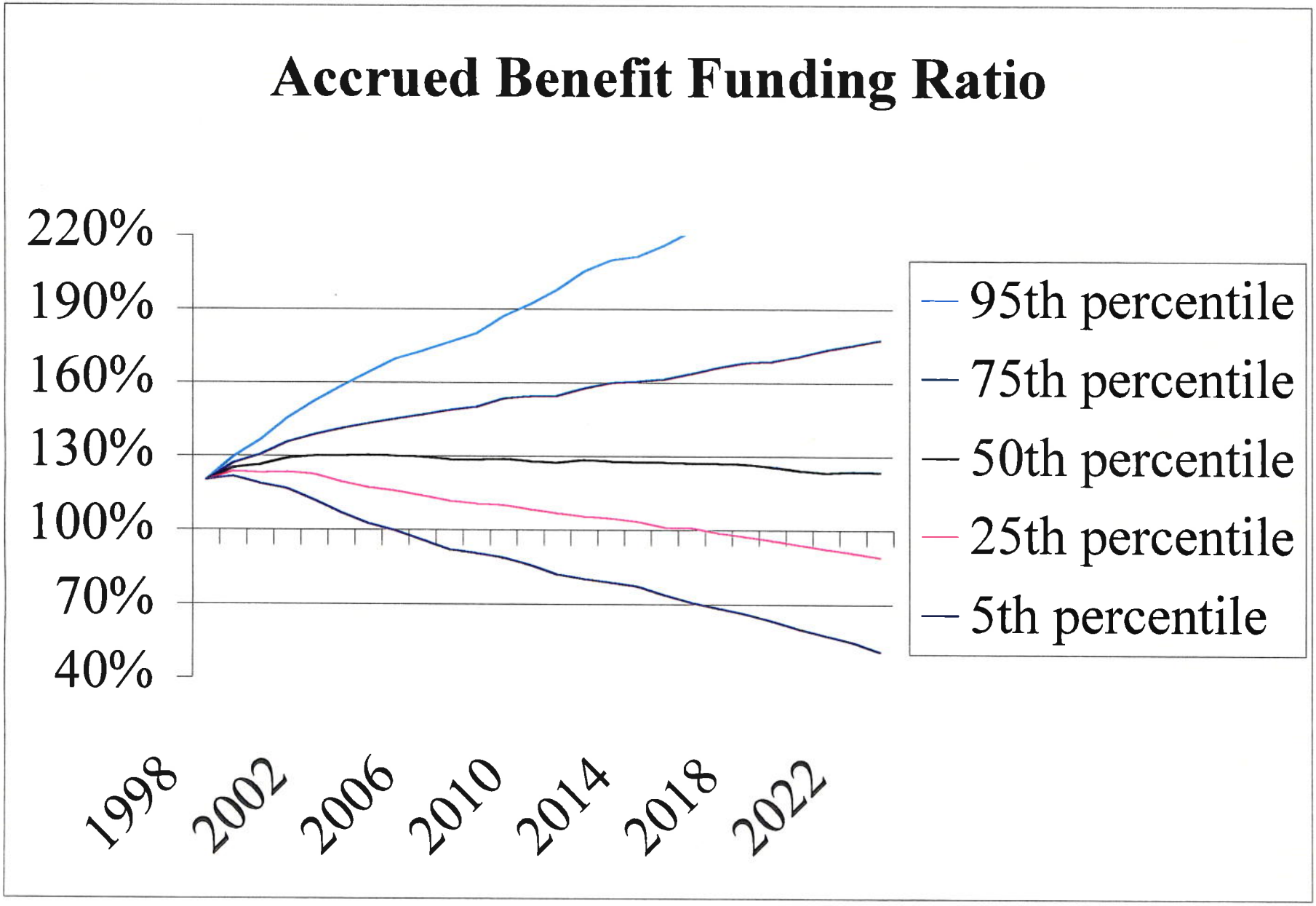
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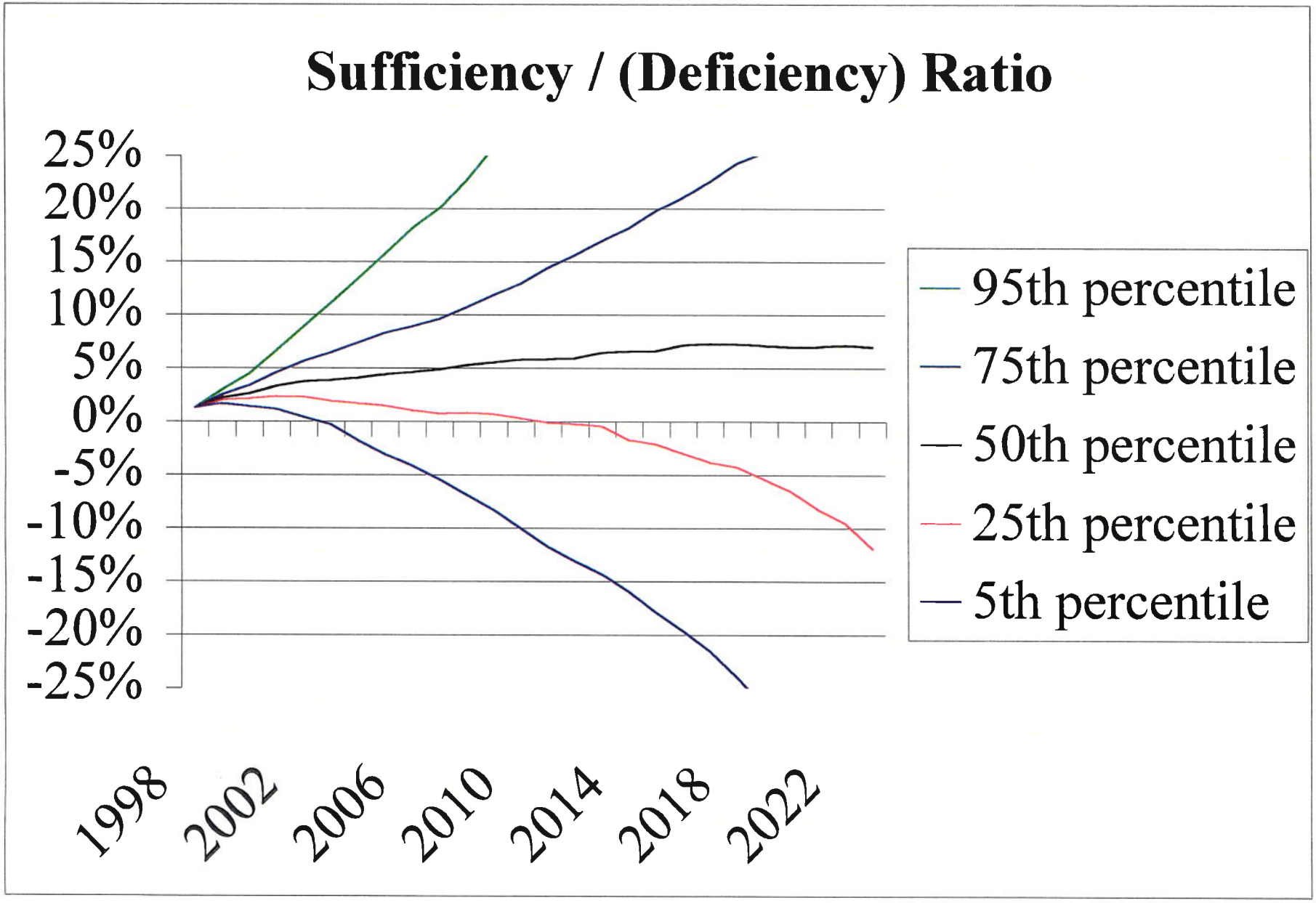
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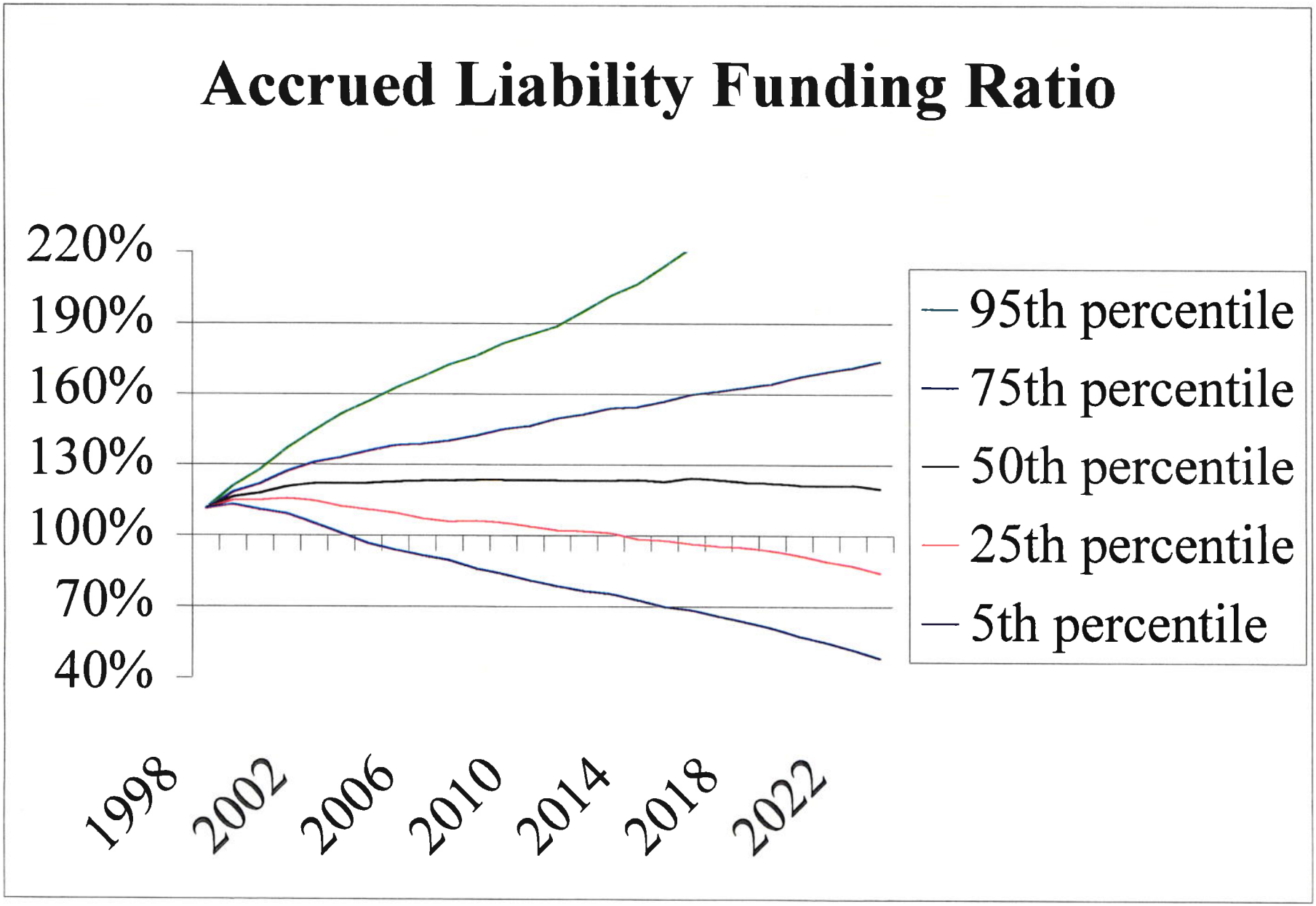
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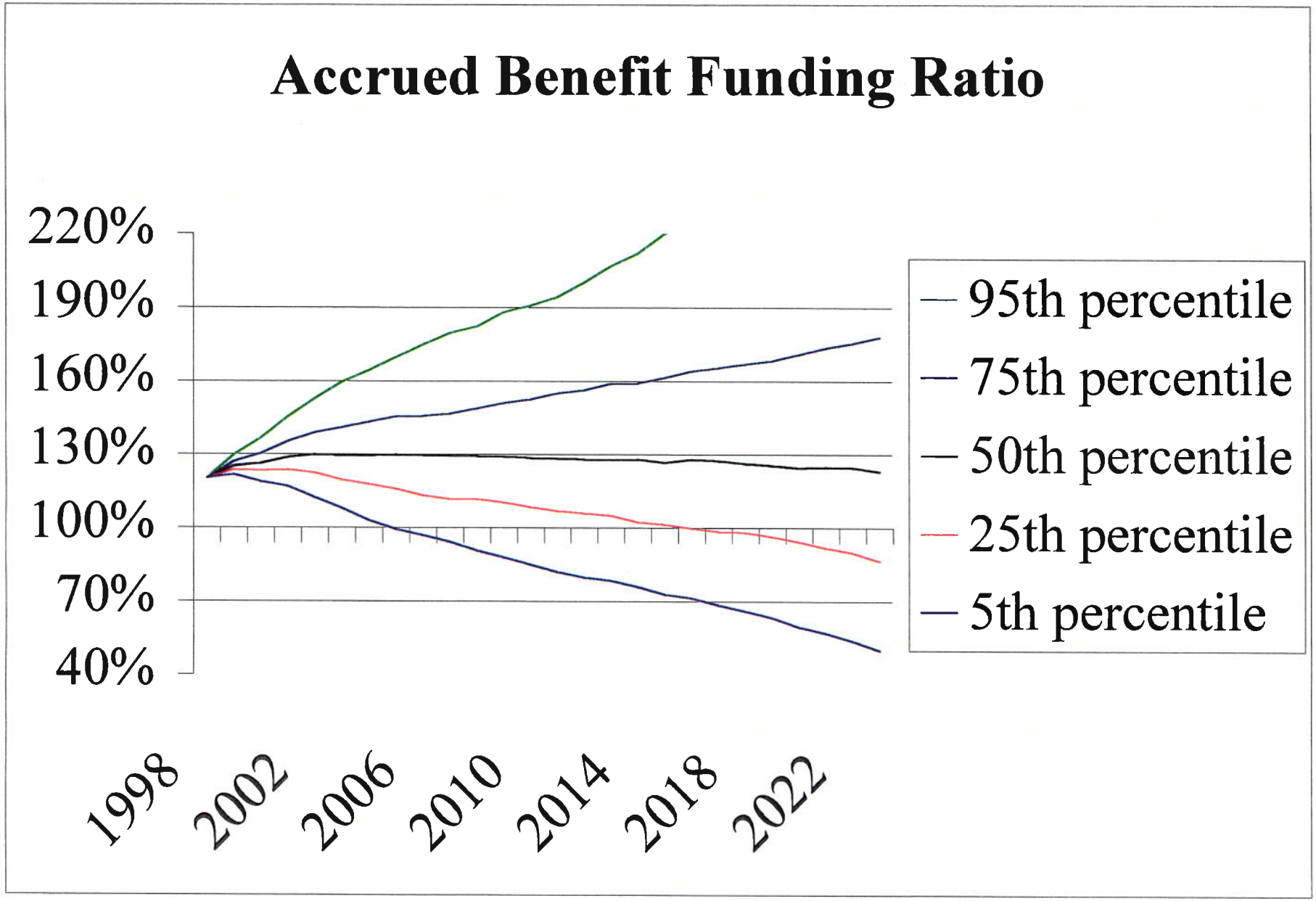
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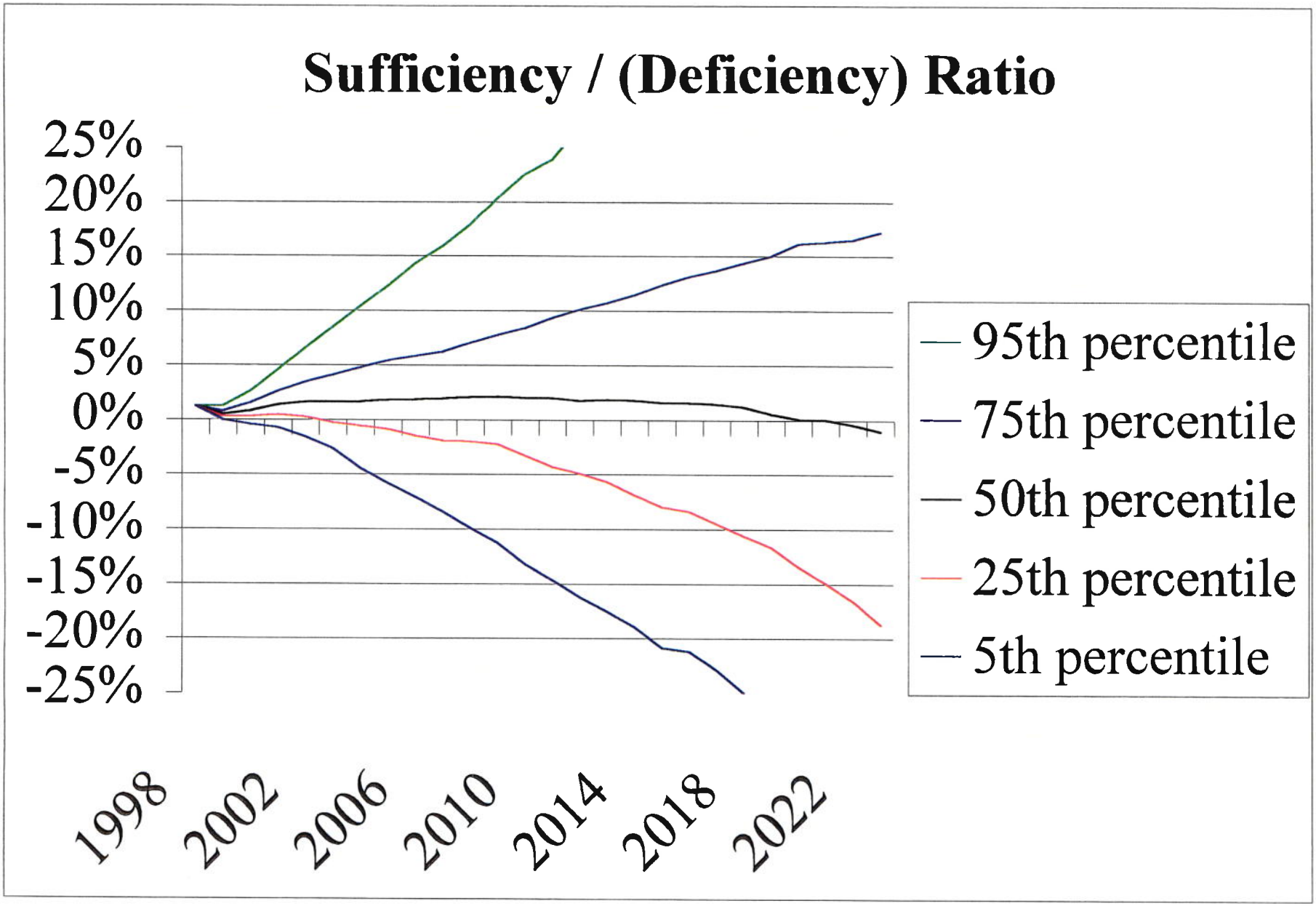
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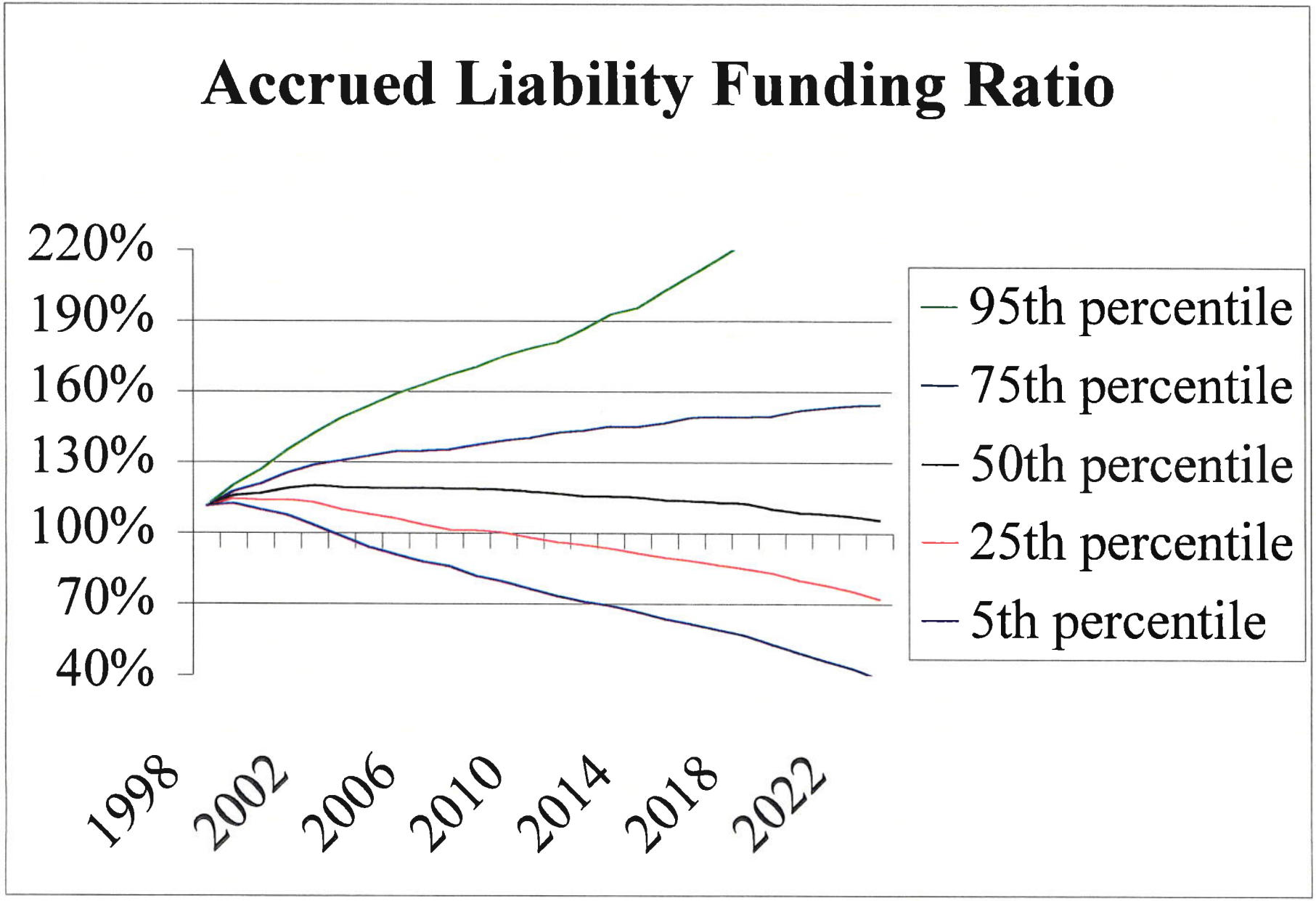
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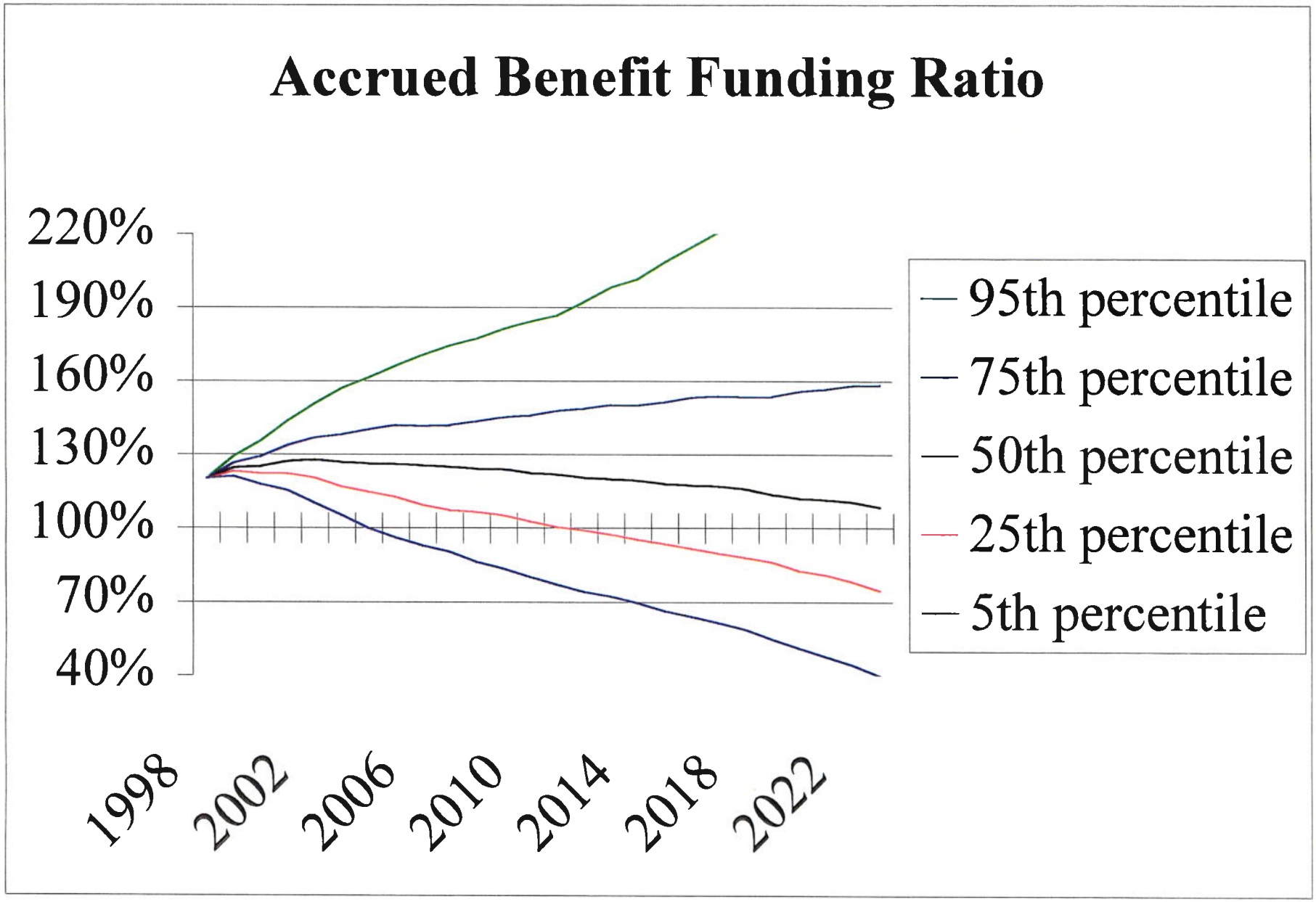
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TABLE 3

Expected Values of Accrued Benefit Funding Ratio

Year	A	B	C	D
1998	122.37%	119.80%	119.80%	119.80%
1999	126.78%	125.11%	125.11%	124.54%
2000	126.19%	126.51%	126.51%	125.40%
2001	126.51%	129.03%	129.03%	127.41%
2002	125.84%	129.77%	129.77%	127.68%
2003	125.36%	129.22%	129.22%	126.63%
2004	125.37%	129.20%	129.20%	126.11%
2005	125.22%	129.04%	129.05%	125.45%
2006	124.35%	128.12%	128.14%	124.08%
2007	123.60%	127.35%	127.37%	122.82%
2008	123.34%	127.05%	127.09%	122.04%
2009	123.08%	126.74%	126.79%	121.24%
2010	122.20%	125.78%	125.85%	119.84%
2011	121.42%	124.94%	125.02%	118.49%
2012	121.18%	124.63%	124.73%	117.68%
2013	120.97%	124.34%	124.47%	116.86%
2014	120.24%	123.51%	123.66%	115.55%
2015	119.49%	122.68%	122.86%	114.16%
2016	119.33%	122.43%	122.64%	113.32%
2017	119.18%	122.20%	122.46%	112.47%
2018	118.59%	121.51%	121.81%	111.22%
2019	117.61%	120.41%	120.74%	109.58%
2020	116.23%	118.93%	119.31%	107.38%
2021	116.03%	118.65%	119.08%	106.34%
2022	115.39%	117.91%	118.41%	104.92%
2023	114.45%	116.90%	117.45%	103.07%

TABLE 4

Median Values of Sufficiency/(Deficiency) Measure

Year	A	B	C	D
1998	(0.49%)	1.19%	1.19%	1.19%
1999	(0.49%)	2.17%	2.18%	0.47%
2000	(0.50%)	2.58%	2.62%	0.79%
2001	(0.51%)	3.30%	3.30%	1.34%
2002	(0.59%)	3.65%	3.73%	1.62%
2003	(0.60%)	3.88%	3.87%	1.61%
2004	(0.62%)	4.13%	4.09%	1.66%
2005	(0.63%)	4.28%	4.41%	1.81%
2006	(0.72%)	4.39%	4.65%	1.86%
2007	(0.74%)	4.36%	4.90%	1.96%
2008	(0.75%)	4.54%	5.29%	2.08%
2009	(0.77%)	4.79%	5.55%	2.13%
2010	(0.86%)	4.79%	5.79%	2.01%
2011	(0.88%)	4.89%	5.86%	1.98%
2012	(0.90%)	5.34%	5.95%	1.73%
2013	(0.92%)	5.53%	6.46%	1.88%
2014	(1.00%)	5.56%	6.61%	1.77%
2015	(1.02%)	5.74%	6.63%	1.57%
2016	(1.05%)	5.86%	7.16%	1.56%
2017	(1.06%)	6.14%	7.30%	1.42%
2018	(1.15%)	6.00%	7.24%	1.18%
2019	(1.18%)	5.93%	7.13%	0.55%
2020	(1.20%)	5.47%	6.99%	0.08%
2021	(1.22%)	5.34%	7.02%	0.04%
2022	(1.30%)	5.58%	7.18%	(0.45%)
2023	(1.33%)	5.52%	7.01%	(1.03%)

Median Values of Accrued Liability Funding Ratio

Year	A	B	C	D
1998	113.33%	110.94%	110.94%	110.94%
1999	117.54%	116.32%	116.24%	115.70%
2000	117.30%	117.88%	117.80%	116.76%
2001	118.05%	120.97%	120.50%	118.96%
2002	118.96%	122.04%	121.98%	120.02%
2003	118.31%	122.57%	121.89%	119.35%
2004	118.93%	123.21%	122.14%	119.18%
2005	120.00%	123.15%	122.62%	118.98%
2006	119.58%	123.08%	123.15%	119.08%
2007	119.62%	122.26%	123.06%	118.66%
2008	120.12%	122.38%	123.38%	118.70%
2009	120.11%	123.02%	123.48%	118.39%
2010	119.45%	122.54%	123.28%	117.50%
2011	118.81%	122.36%	123.34%	116.82%
2012	119.74%	123.44%	123.07%	115.59%
2013	119.41%	123.10%	123.10%	115.65%
2014	119.39%	122.81%	123.56%	115.13%
2015	119.33%	123.28%	122.61%	114.01%
2016	120.15%	122.81%	124.17%	113.54%
2017	119.40%	123.19%	123.42%	112.94%
2018	119.12%	122.94%	122.55%	112.50%
2019	119.29%	121.85%	122.02%	110.19%
2020	117.37%	120.54%	121.20%	108.74%
2021	117.88%	119.56%	121.18%	108.12%
2022	117.19%	120.27%	121.28%	107.10%
2023	116.30%	119.88%	119.81%	105.40%

Probability of Unfunded Actuarial Accrued Liability
in Year of Valuation

Year	A	B	C	D
1998	0.00%	0.00%	0.00%	0.00%
1999	0.10%	0.00%	0.00%	0.00%
2000	1.90%	0.00%	0.00%	0.00%
2001	5.10%	0.00%	0.10%	0.10%
2002	8.90%	1.50%	1.00%	2.30%
2003	12.50%	5.10%	4.60%	7.50%
2004	14.80%	7.40%	8.50%	11.00%
2005	17.00%	10.30%	11.00%	14.70%
2006	21.00%	13.70%	13.40%	18.40%
2007	20.50%	16.90%	16.40%	22.50%
2008	21.50%	17.90%	17.70%	23.60%
2009	22.40%	18.70%	18.30%	24.90%
2010	24.60%	20.80%	19.80%	27.50%
2011	25.60%	22.60%	21.70%	29.40%
2012	26.60%	23.60%	23.10%	30.80%
2013	27.70%	24.70%	24.30%	32.10%
2014	28.30%	25.80%	25.80%	33.50%
2015	29.40%	27.20%	27.10%	35.80%
2016	30.50%	27.20%	28.30%	36.90%
2017	31.50%	28.20%	28.50%	38.80%
2018	33.20%	29.60%	29.40%	40.40%
2019	35.90%	30.70%	32.50%	42.00%
2020	36.20%	32.30%	34.70%	44.10%
2021	36.20%	33.10%	35.50%	45.50%
2022	37.40%	34.40%	36.20%	45.80%
2023	38.40%	35.20%	37.30%	46.20%

Probability of Unfunded Actuarial Accrued Liability
in Any Year up to Valuation

Year	A	B	C	D
1998	0.00%	0.00%	0.00%	0.00%
1999	0.10%	0.00%	0.00%	0.00%
2000	1.90%	0.00%	0.00%	0.00%
2001	5.30%	0.00%	0.10%	0.10%
2002	9.80%	1.60%	1.00%	2.30%
2003	14.30%	5.20%	4.60%	7.50%
2004	17.90%	7.70%	8.50%	11.10%
2005	21.10%	10.70%	11.20%	15.10%
2006	26.50%	14.60%	14.30%	19.60%
2007	27.80%	18.40%	17.80%	24.30%
2008	30.00%	20.40%	20.30%	26.40%
2009	31.70%	22.10%	21.80%	28.90%
2010	34.50%	24.60%	24.00%	31.90%
2011	36.00%	27.30%	26.30%	34.30%
2012	37.20%	29.00%	28.50%	36.00%
2013	38.60%	30.80%	30.10%	37.80%
2014	39.80%	32.10%	31.50%	39.40%
2015	41.10%	33.30%	33.10%	41.50%
2016	42.30%	34.20%	34.50%	42.90%
2017	44.00%	35.50%	35.00%	45.10%
2018	45.00%	36.80%	36.30%	46.90%
2019	46.60%	38.10%	38.70%	48.20%
2020	47.60%	39.40%	40.50%	49.90%
2021	47.90%	40.30%	41.50%	51.10%
2022	48.50%	41.40%	42.30%	51.70%
2023	49.20%	42.20%	43.30%	52.20%

SECTION III: INTERPRETATION AND COMMENTS

Observations

Scenario A. Looking at graphs A1, A2, and A3, we get a sense for the range of possibilities assuming no change in current law, methods, benefits, contributions, or size of group. A1 shows that absent recognition of the negative UAL, the plan is expected to remain slightly deficient. Note that costs are expected to stay stable in 75 percent of the projections until 2010 when the 25th percentile line starts to diverge and shows greater deficiencies. This crossover point is demonstrated again in graph A2 where the 25th percentile line crosses the 100% funded line. A2 also shows that the median line stays relatively stable in the 115-120% funded range while the 75th percentile line moves past 150% at about 2015. Graph A3 shows that the projected accrued benefit funding ratio is expected to stay above 120% although the 25th percentile line crosses the 100% line in 2014.

Scenario B. The big change from Scenario A is shown in graph B1. If the negative UAL is recognized, the sufficiency measure is expected to improve with the median value growing to over 5%. The 25th percentile line begins to show deficiencies in 2012, slightly later than Scenario A due to a modest extension of the recognition of market losses under the proposed asset valuation method. The proposed asset valuation method has a similar impact on extending the point when the 25th percentile line crosses the 100% funded level in graphs B2 and B3 as well.

Scenario C. The graphs for the declining population scenario show very little difference from Scenario B. The graphs tend to spread out even further in the later years demonstrating the even greater dominance of asset experience over liability experience and also reflecting a somewhat diminished payroll base.

Scenario D. This scenario with decreasing contribution rates is also a proxy for scenarios with modest benefit improvements. This scenario does project a majority of trials to be sufficient all the way out to 2022, while median values for both funding ratios remain above 100% through 2023. Nonetheless, this scenario does demonstrate the sensitivity to even modest changes in benefits or contributions. The 25th percentile line shows deficiencies starting in 2003 and the accrued liability funding ratio goes below 100% at the 25th percentile line four years earlier than Scenario B.

TABLE 3. If the economy performs "as expected" throughout the study period, we can see that the projected unit credit funding ratio is expected to increase modestly in the first few years then decline modestly thereafter, except for Scenario D where the decline is somewhat more pronounced.

TABLE 4. This table shows the greatest disparities among the four scenarios. Since current methods do not recognize any negative unfunded in determining required contribution rates, median values show increasing deficiencies driven by the projected mortality improvements. The proposed new methods would recognize the existing (and growing) negative UAL. Therefore, Scenario B shows median values for sufficiency which increase for about 20 years before starting a modest decline. With a decreasing population, the median sufficiency values increase even more, leveling off around 7% in the later years. The reduction in contributions reflected in Scenario D result in median sufficiency values which increase very modestly for about 10 years, then start to decrease changing over to deficiencies in the last two years of the projection.

TABLE 5. This table shows that the median values for the accrued liability funding ratio are expected to increase modestly for five years or so then level off for 15-20 years, then show very slight reductions. The increases are somewhat less and the decreases start sooner under the scenario with decreased statutory contributions.

TABLES 6 AND 7 are intended to provide some insight as to the "level of risk," where the "event" being watched is the probability that the System will emerge with an unfunded liability in some future year. These percentages are very small in the early years. The percentages increase as time passes under all four scenarios. While the differences between scenarios are not great, this table shows that the proposed actuarial value of assets does modestly diminish the likelihood of a positive UAL emerging. Clearly, a contribution reduction (or benefit increase) would increase the chances for a positive UAL.

Final Comments

The natural question to ask at this point is, "*What does it all mean?*" While these types of studies do not give you bright line, yes-or-no, type answers, there is a wealth of information included in these results. A few reasonable conclusions include:

1. Asset performance is and will be the single most important factor in determining the future funded status of the plan. This fact has significant implications for investment policy and asset valuation methodology. Furthermore, long term stability is likely to be uncertain, at least with the current allocation of assets.
2. Absent changes, the probability that the State Employees Retirement Fund will become underfunded in the near future is relatively small, reaching 20% in eight years. The 20% threshold is pushed out about four more years with the proposed asset valuation method.
3. Even relatively modest changes in benefits and/or contribution rates may substantially increase the potential for future positive UAL and/or contribution deficiency.
4. Policy makers need to employ a long term perspective when evaluating appropriate actions based on current funded status.

5. While interpreting these results, it is important to remember the nature of the projection. Absolute values are uncertain at best. Outlying results provide some measure of the potential range of results but should not be viewed as "likely" nor as absolute "outerbounds."

We would be happy to respond to questions or comments from any of the recipients of this study. We believe the most beneficial aspects are achieved when these projections are viewed as a learning tool.