

Pensioner Mortality in the New York State Public Retirement Systems

Summary

New York State has mortality data going back to 1921. When we looked at that data, and graphed the mortality experience, with particular attention paid to the recent data after 1986 we noticed a smooth asymptotic trend in the curve of the mortality rates by age over the years, as well as a smooth asymptotic trend in the curve of the mortality rates by years for each age. This led us to examine a recursive method of forecasting as well as an exponential method. Based on a recursive method, we forecasted future mortality rates and then calculated the effects on the liabilities and the funding of the New York State Retirement System. The results showed, that based on patterns from the past continuing into the future, mortality rates thirty years from now for pensioners over age 80 would be approximately 67% of our current assumptions. This would translate in the life expectancy of a sixty-two year old pensioner changing from approximately 22 years to approximately 26 years, and an increase in the current new entrant rate of approximately 7.9%. These changes, although not insignificant, would be realized gradually over the next thirty years and would not represent an immediate burden. Again, this assumes that medical and social breakthroughs in the future will have no more of an impact on mortality than the changes which we have experienced over the last eighty years.

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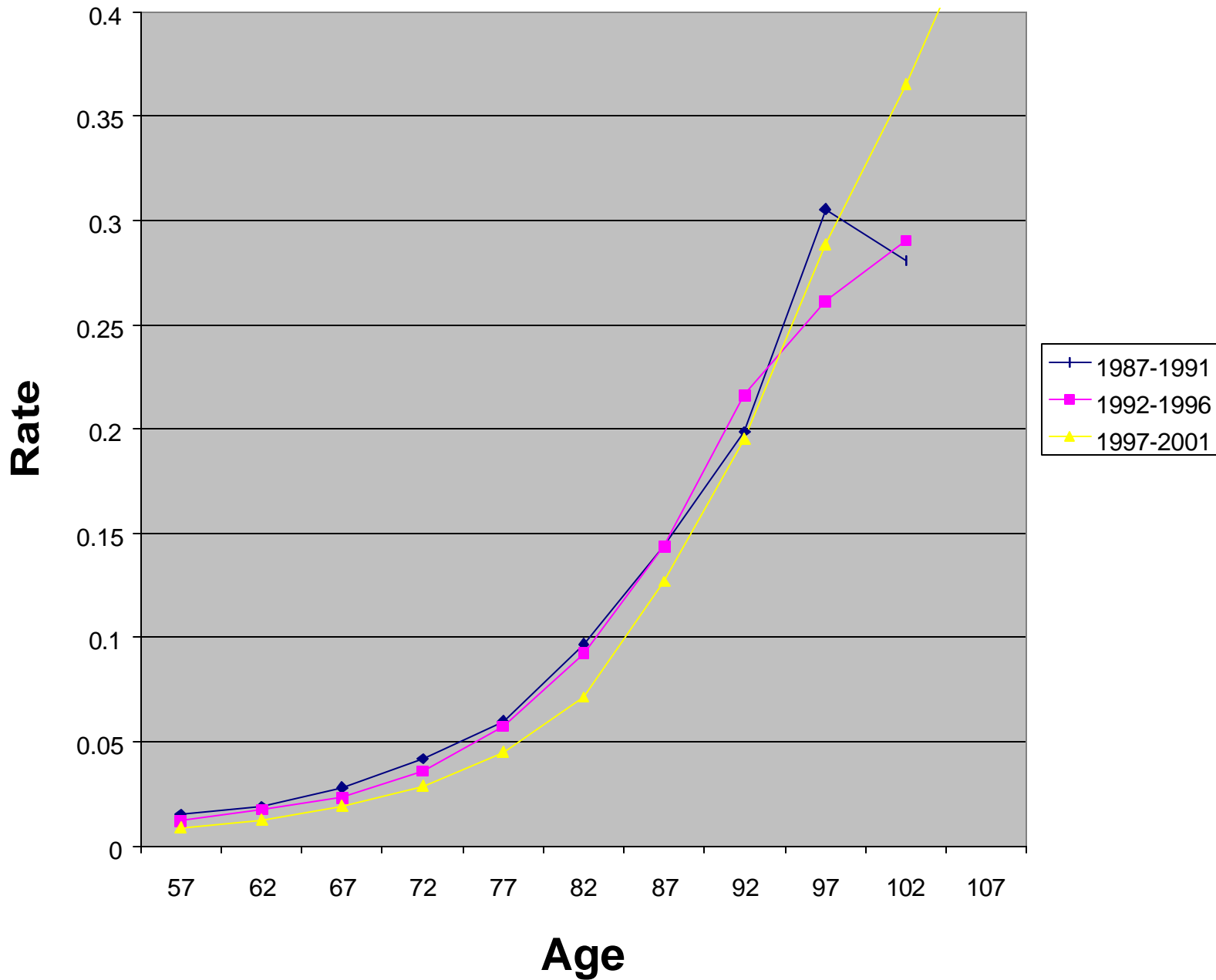
Introduction

The New York State and Local Employees' Retirement System has been providing retirement benefits to municipal employees since 1921. There have been more than 550,000 pensioners and beneficiaries paid in that time, with the current number of pensioners and beneficiaries in excess of 290,000. This collection of data shows a trend in mortality during a period of many medical breakthroughs and social improvements. The last fifteen years begin to show longevity reaching into ages beyond ninety. The question remains, however, what trends does the future hold, and can any information be gleaned from the past.

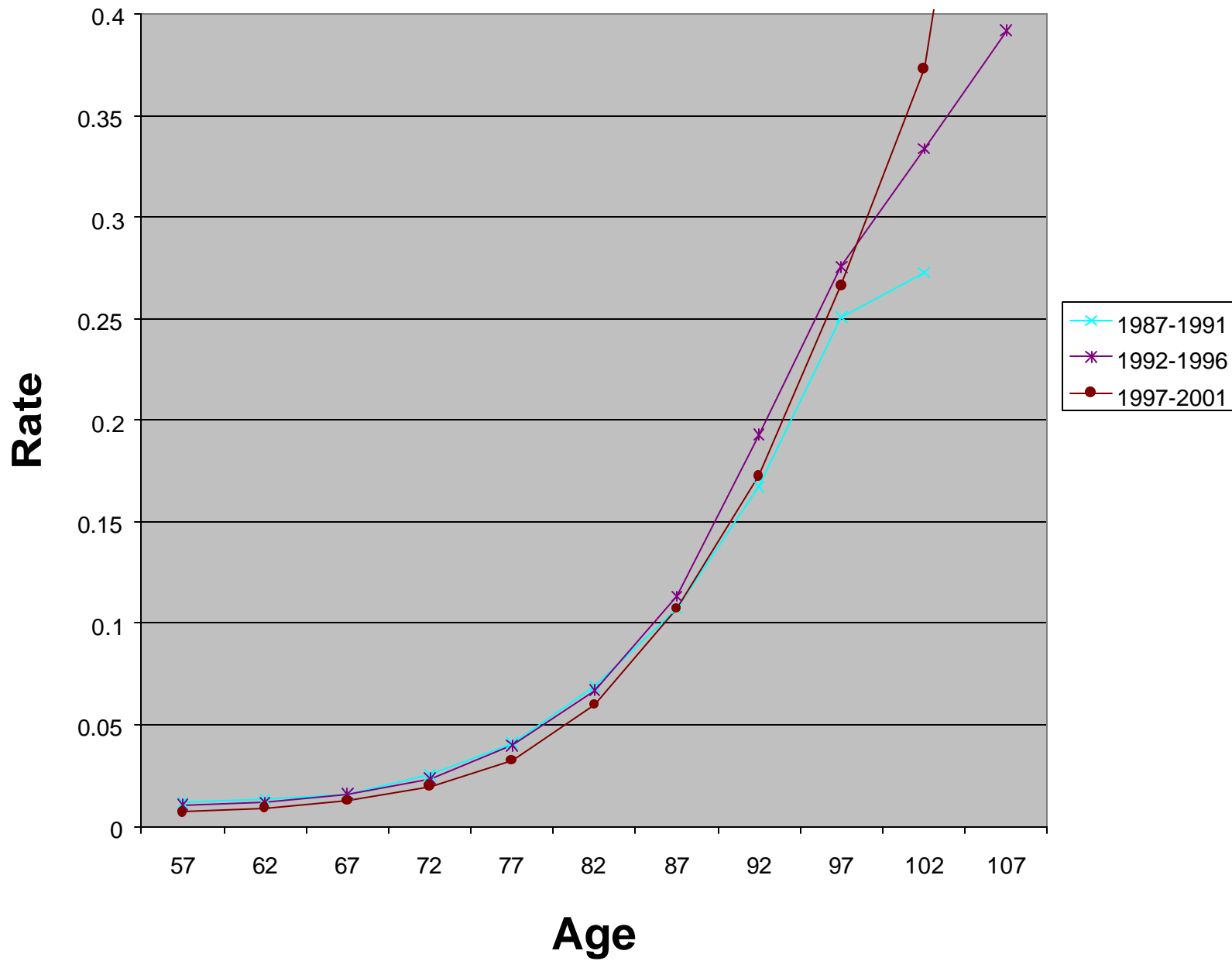
The Last Fifteen Years

Attached are tables and graphs of our experience by allowance over the last fifteen years, broken down by gender. For our own purposes, we would also sort this data by job type (i.e. clerical, laborer, police officer, firefighter or beneficiary) and retirement type (i.e. service or disability). For this study, however, since we're interested in mortality at advanced ages where such distinctions lose their significance, we combined retirement types and job types.

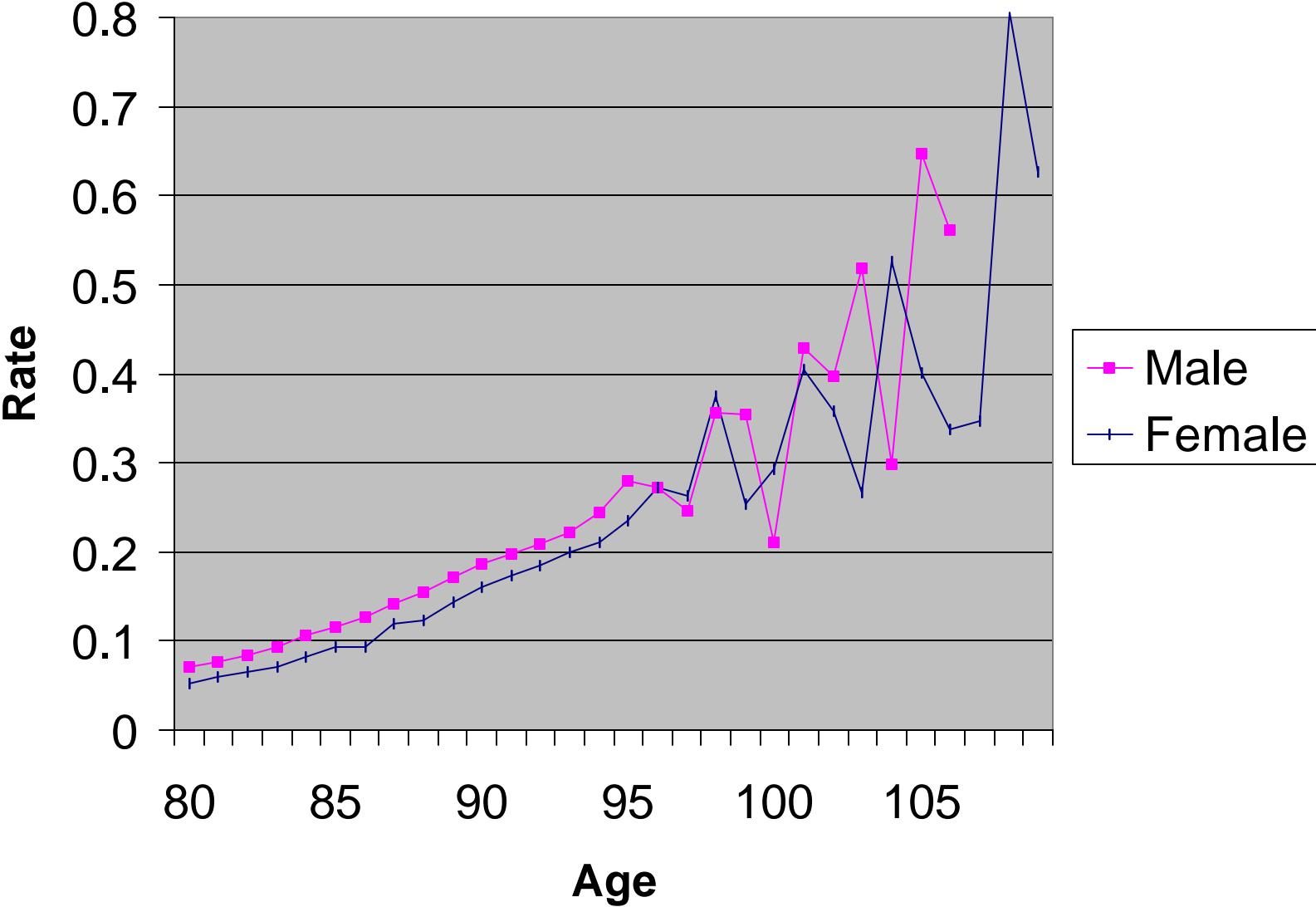
Male Mortality Experience by Allowance



Female Mortality Experience by Allowance



Female versus Male Mortality Experience 1987-2001 by Allowance

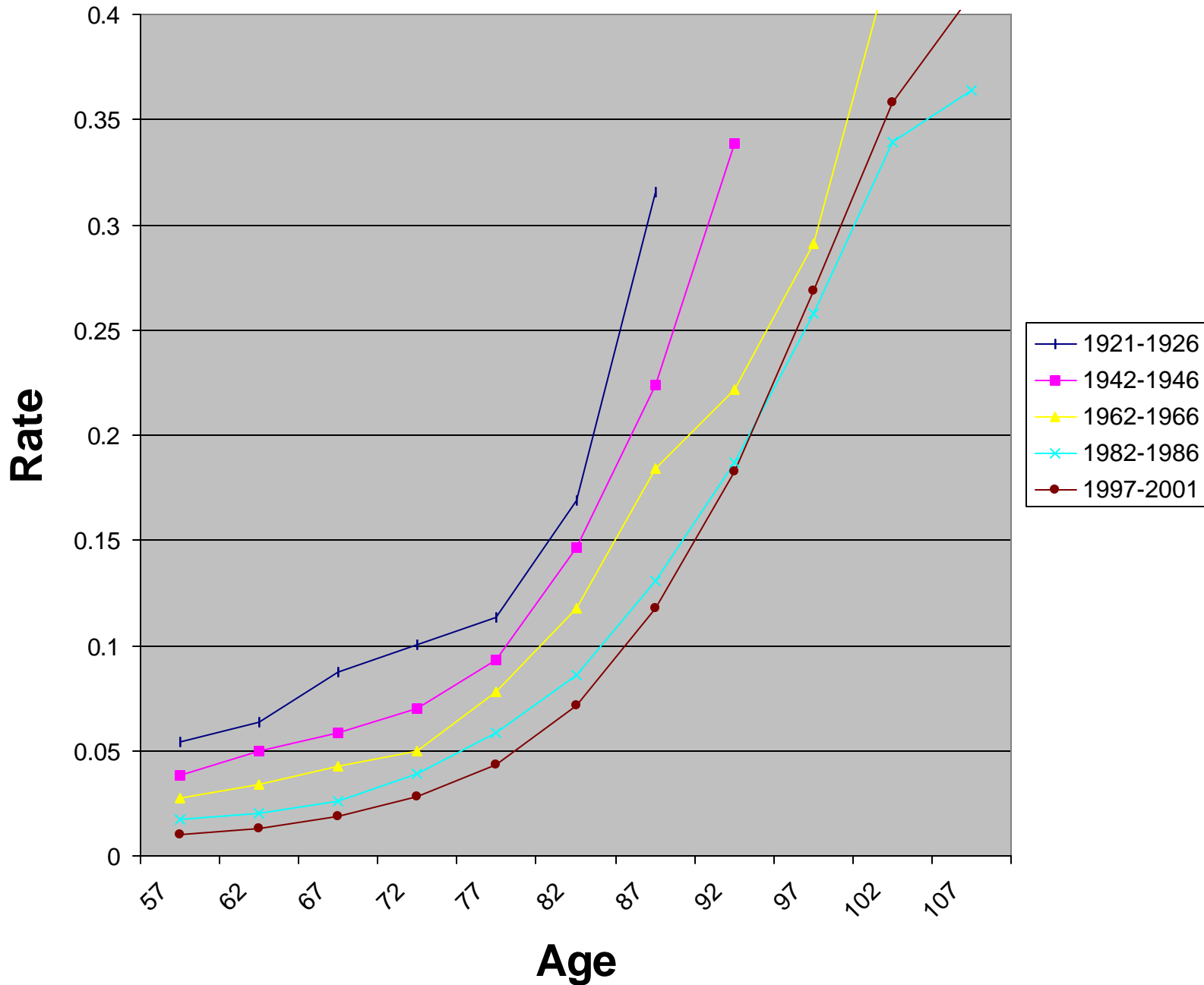


Possible Trends

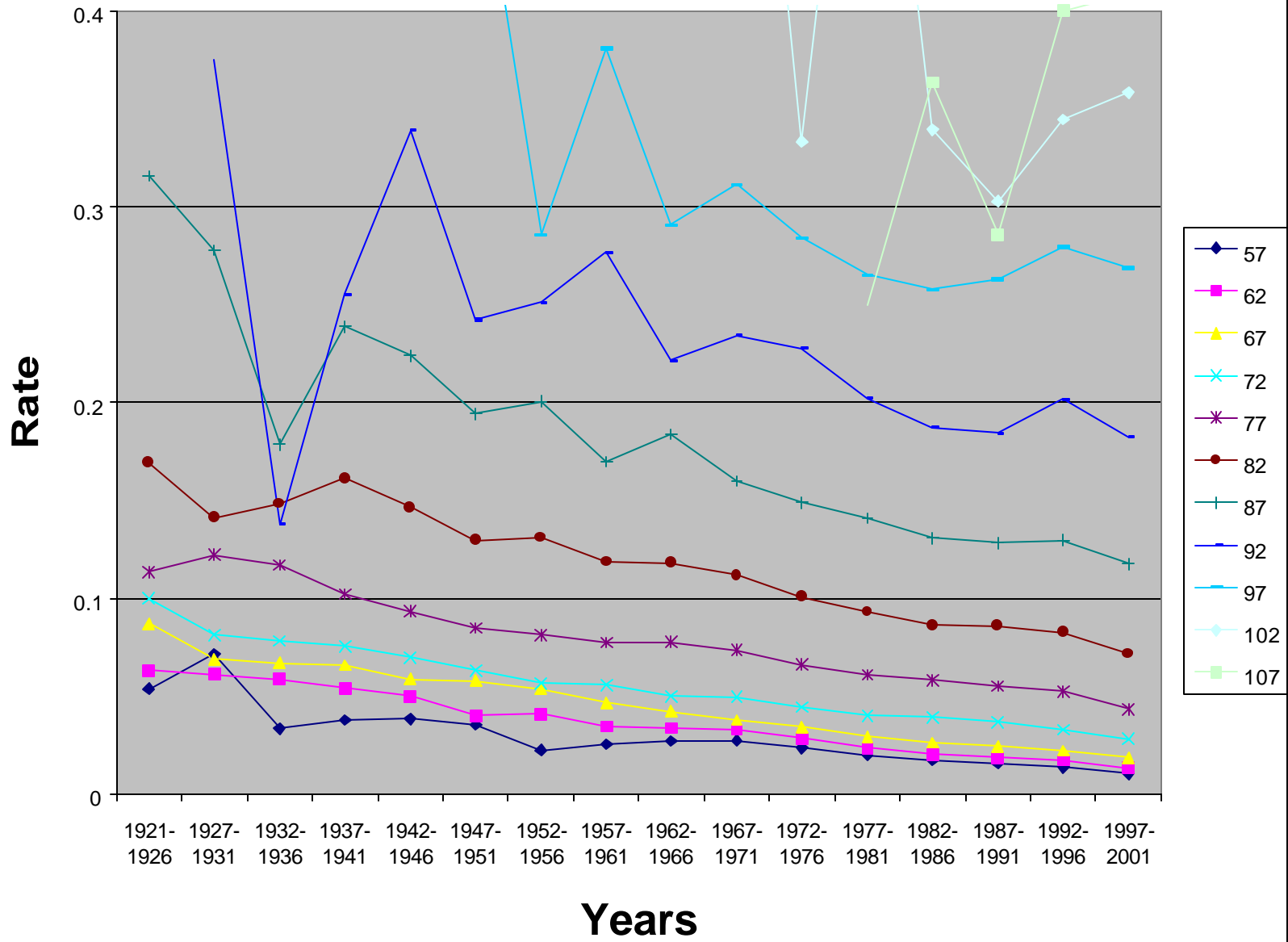
Attached are two graphs of the data, by number, that has been accumulated over the past eighty years. The first graph shows a laying down trend in the curve of age versus mortality rate as we look at selected five year data since 1921. This is what we would expect as an effect of societal and medical changes. The second graph, of each centralized age of mortality rate versus the years the data was accumulated, seems to show a regressive relationship in the mortality at each age as the years have passed. For instance, the mortality rate for the age 77 group in the period 1937 to 1941 is about the same as the mortality rate for the age group 82 in the period 1972 to 1976. Also shown here is how wild the age 87 and 92 rates were, from 1921 through 1966 and how nicely they settled into a pattern after that. Now you can notice how wild the age 97 and above rates are, but you can also see the beginning of a pattern being set there as well.

The graphs appear to have an exponential quality. We looked at fitting them into the Lee-Carter Method for Forecasting Mortality (North American Actuarial Journal, January 2000), but couldn't get it to forecast trends that were as palatable as the regression method. The thought of an exponential mortality curve is enticing, however, we were not able to isolate all of the variables that were necessary to create viable forecasts.

Total Mortality Experience by Number



Mortality Experience by Number



Impact on the liabilities and the funding for the New York State and Local Employees' Retirement System.

Using the recursive relationship noticed earlier, and shifting our current mortality rates at each five year centralized age to be that of age minus five, we can crudely estimate what the mortality rate at each age will be in about the year 2036. These projected rates end up being approximately 67% of our current expected mortality rates. The life expectancy for a current retiree age 62 on our current assumptions is approximately 22 years, whereas a retiree age 62 on the projected rates would have a life expectancy of approximately 26 years. In calculating liabilities based on these mortality rates, the concern is that our current demographics do not reflect this improved mortality and that actual liabilities in 2036 will be based on far more pensioners and beneficiaries being over age 90 and even over age 100. However, as a starting point, I valued our currently active members on the new projected pensioner mortality rates. As a result, the present value of benefits for current members increased by 4.2 billion. This represents a percent change of approximately 6.1% and a change in future normal rate of approximately 2.5% of salary. In addition, I valued our current pensioners on the new projected pensioner mortality rates. This generated an increase in present value of benefits of approximately 2.7 billion. This represents a percent change of approximately 9.1% and a change in future normal rate of approximately 1.6% of salary. The changes in mortality will be gradual and if we do see these changes, the effects will be phased in gradually in the future. Another way of looking at the effects of these changes is by looking at how the new entrant rate will be affected. By calculating the new entrant rate on the new projected pensioner mortality rates and then comparing that to the current new entrant rate there would be an increase in the new entrant rate of approximately .8% of salary, this corresponds to a 7.9% increase in the current new entrant rate. These increases are not small, but since we would realize them gradually, we should be prepared for them through our current process of creating new mortality tables every five years from our most recent experience and using the 25% loading factor. These assumptions assume that the trends from the past will continue into the future and thereby, that medical and societal changes in the future will be no more significant than the changes over the past eighty years, until proven otherwise.

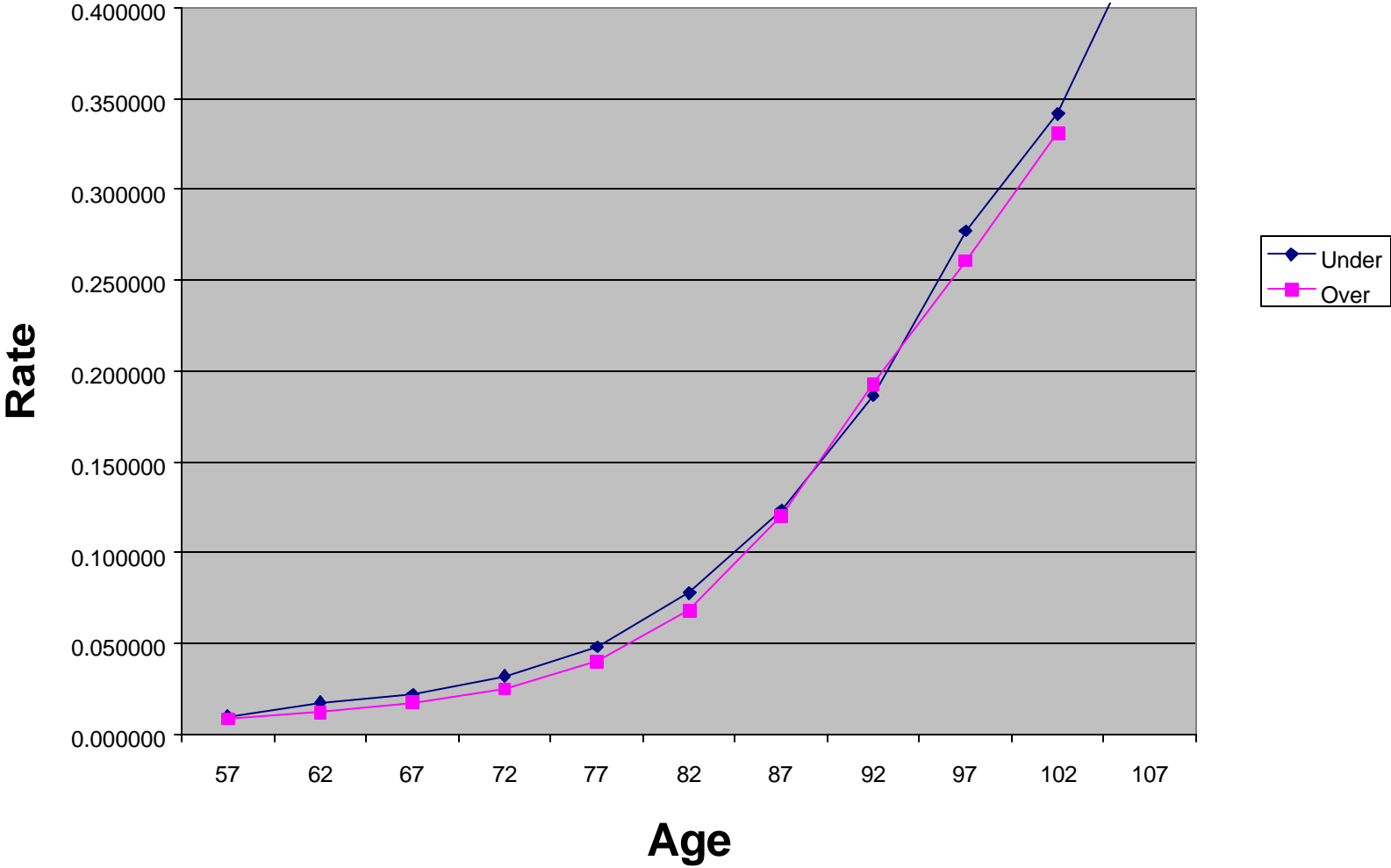
Possible factors that have had an effect on the mortality experience of the New York State and Local Employees' Retirement System.

New York State has historically been a progressive, industrialized state with good health care and an above average standard of living. So it would not be surprising if Mortality rates in New York State were lower than the national rates and Global rates. However, the New York State Retirement System mortality rates are higher than the national rates in the UP83, GAM83, UP94, and GAM94 tables. Perhaps this may be accounted for by the differences in the way the tables are created and the differences in the characteristics of the individuals. In particular, that we grouped service retirees and disability retirees together even though disability retirees have significantly higher mortality rates at the lower ages.

We also looked at pensioners since 1987 broken down into two groups. The first group consists of pensioners who are receiving annual benefits which are less than twice the minimum wage of the year that they started receiving benefits. The second group consists of pensioners who are receiving annual benefits which are more than twice the minimum wage of the year that they started receiving benefits. The level of twice minimum wage was chosen because about half of the exposures fell into the under and into the over group. The attached graphs of that data shows no significant differences. This is not what one might expect, until you consider that a pension benefit should not be their sole means of support and that the majority of these pensioners have had health insurance. The results do lend some credibility to the consistency of the data over these years as a homogeneous group.

Lastly, New York State may be a reasonable model, because it has been a progressive state for this eighty year period. There has been a smooth transition in mortality rates over these years, not a cliff scenario where they would be catching up with medical and social advances.

Compare Mortality Experience by Allowance for pensions under and over twice minimum wage



Total Exposures by Allowance for Females

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
80	5,232,250	6,016,564	6,694,315	7,130,948	7,585,551	8,951,917	8,508,692	10,059,788	11,033,043	13,090,381	13,271,518	14,928,140	17,104,286	16,223,981	20,127,297
81	4,151,612	5,057,405	5,722,636	6,327,991	6,726,511	7,245,946	8,672,209	8,048,768	9,468,153	10,557,181	12,423,630	12,706,100	14,103,048	16,280,752	15,189,744
82	3,444,799	3,986,261	4,718,224	5,417,429	6,032,432	6,326,913	6,839,937	8,112,819	7,642,560	8,834,403	10,023,733	11,572,661	12,025,033	13,358,306	15,369,511
83	2,798,581	3,272,044	3,775,444	4,449,910	5,101,649	5,589,525	5,998,165	6,416,137	7,637,515	7,168,114	8,315,142	9,290,415	10,699,939	11,126,504	12,374,674
84	2,123,042	2,588,018	3,013,590	3,518,293	4,081,826	4,706,703	5,285,566	5,640,678	5,964,994	7,082,519	6,709,457	7,644,434	8,667,249	9,824,341	10,310,163
85	1,984,651	1,976,035	2,384,071	2,791,225	3,260,103	3,769,170	4,368,568	4,872,808	5,141,707	5,359,036	6,567,944	6,145,304	6,928,583	8,001,088	8,960,807
86	1,444,075	1,868,383	1,846,849	2,160,181	2,562,049	3,009,434	3,511,690	3,925,344	4,534,885	4,559,598	4,893,794	5,874,685	5,519,383	6,205,482	7,096,196
87	1,070,766	1,360,527	1,658,297	1,697,233	2,031,568	2,360,490	2,713,364	3,203,295	3,568,600	4,213,721	4,119,202	4,434,226	5,259,024	4,953,480	5,488,923
88	848,487	930,277	1,238,845	1,468,241	1,572,106	1,757,076	2,098,096	2,395,507	2,803,942	3,131,720	3,797,144	3,629,791	3,845,584	4,576,049	4,201,587
89	691,747	755,716	790,412	1,065,016	1,326,522	1,353,577	1,557,482	1,799,631	2,076,760	2,457,911	2,730,135	3,328,140	3,216,273	3,321,046	3,997,943
90	531,469	594,336	669,121	684,953	936,294	1,107,210	1,154,489	1,324,231	1,555,684	1,795,009	2,030,652	2,317,266	2,777,024	2,790,842	2,715,623
91	397,291	439,619	492,391	573,471	613,394	821,406	962,972	969,889	1,112,712	1,261,363	1,474,057	1,732,173	1,977,712	2,255,635	2,251,053
92	284,118	344,047	379,906	416,476	487,324	531,534	634,233	809,920	794,770	922,260	1,013,409	1,177,218	1,446,637	1,582,780	1,738,786
93	221,999	236,060	292,422	289,213	328,991	378,046	422,427	496,262	645,745	649,837	762,000	804,117	974,294	1,154,966	1,250,593
94	155,216	198,797	213,264	230,222	225,787	291,632	301,843	352,687	362,386	517,470	487,592	565,158	635,426	783,755	895,796
95	105,149	126,251	159,065	191,435	185,577	179,182	229,209	234,684	277,381	268,074	407,448	372,400	427,736	512,201	591,464
96	61,521	87,367	106,568	115,172	133,996	157,847	123,906	169,470	168,866	217,808	236,295	341,061	301,456	278,881	368,157
97	43,038	47,845	52,569	78,942	88,056	121,451	126,728	88,760	133,569	126,872	137,978	147,364	231,495	219,378	171,995
98	46,587	30,898	34,849	35,482	61,855	74,335	103,235	82,671	72,308	97,882	88,752	106,305	96,531	158,309	154,550
99	14,975	29,123	18,925	21,669	26,728	38,338	48,370	27,362	61,326	41,840	72,469	56,032	64,499	53,470	109,777
100	5,628	9,092	17,859	10,179	12,332	24,792	31,977	40,892	22,701	38,020	32,551	49,275	44,203	51,837	35,011
101	9,985	5,628	5,121	12,979	9,031	10,164	19,425	16,617	22,267	20,647	24,871	27,124	41,548	27,911	36,441
102	2,429	6,686	4,563	2,379	9,817	6,997	4,650	16,240	12,231	5,657	19,156	11,266	10,049	19,010	17,633
103	834	2,429	6,078	4,563	1,836	3,041	5,927	4,650	13,595	9,601	1,625	11,431	1,535	7,122	7,171
104	0	0	2,429	6,078	3,026	648	3,041	2,445	4,650	7,060	3,146	788	11,431	1,535	3,603
105	0	0	0	2,429	3,007	852	648	3,041	592	3,798	824	0	0	3,868	984
106	425	0	0	0	2,429	2,303	0	0	1,356	592	3,798	824	0	0	0
107	695	0	0	0	0	1,829	2,303	0	0	1,356	592	1,698	0	0	0
108	162	695	0	0	0	0	252	2,303	0	0	0	592	1,698	0	0
109	0	162	695	0	0	0	0	252	0	0	0	0	0	0	0
110	0	0	162	0	0	0	0	0	252	0	0	0	0	0	0
111	0	0	0	162	0	0	0	0	0	252	0	0	0	0	0
112	0	0	0	0	162	0	0	0	0	0	252	0	0	0	0
113	0	0	0	0	0	162	0	0	0	0	0	252	0	0	0
114	0	0	0	0	0	0	162	0	0	0	0	0	252	0	0
115	0	0	0	0	0	0	0	162	0	0	0	0	0	0	0
116	0	0	0	0	0	0	0	0	162	0	0	0	0	0	0
117	0	0	0	0	0	0	0	0	0	162	0	0	0	0	0
118	0	0	0	0	0	0	0	0	0	0	162	0	0	0	0
119	0	0	0	0	0	0	0	0	0	0	0	162	0	0	0
120	0	0	0	0	0	0	0	0	0	0	0	0	162	0	0

