Act I

A Mayor Meets His Actuary
A Play In 3 Acts
By Conrad M. Siegel

United States of America

Mayor Trustbutverify, having been elected on a good government pledge, has scheduled a meeting with his pension plan actuary, I.M. Wright in the mayoral office. The time, 10 A.M. early in 1998.

Mayor: Welcome to our fair city; you're new aren't you?

Actuary: Yes, our firm was low bidder responding to the request for proposal for actuarial services.

Mayor: What's the good news?

Actuary: I'm afraid it isn't good - our numbers show that the city's contribution rate is inadequate and should be twice as high as last year.

Mayor cleans mess on coffee table after dropping his cup.

Mayor: Why the big increase?

Actuary: We reduced the investment return assumption to 8.25%. Since your plan is nearly fully funded, the leveraging effect of reducing the return assumed on assets results in doubling the contribution rate.

Mayor: You are aware that we switched to index fund common stock index funds as our main investment. Incidentally one by-product of the switch was a reduction in M.B.A.'s in Armani suits and Gucci loafers explaining why they didn't beat the index last year but will do better this year. We have enjoyed total returns exceeding 20% in each of the last three years.

Actuary: Yes. Our assumption model takes into account your investment policy. The reason your plan is so well funded is due your good fortune in recent investment returns.

Mayor: What do you suggest?

Actuary: Increase the city contribution or increase employee contributions, or reduce benefits.

Mayor: Employees have been asking for increases in benefits, not reduced benefits or increased member contributions! If we don't follow your suggestion, then what?

Actuary: Tax rates will go up in future.

Mayor: Let's look at your model.

Actuary: It is really neat. We call it the building block assumption model. It starts with the inflation assumption as the foundation. We use 3.5%. Your automatic post-retirement increases (COLA) are based on the Consumer Price Index (CPI).

Mayor: But the CPI increase is under 2% now and the government has just announced that the method of calculating price increases overstates the rate by 1.1%.

Actuary: 3.5% is a long term assumption. It comes from the accepted authority, the Ibbotson data which is updated every year. We looked at 10 year periods ending in 1956, 1966, 1976, 1986 and 1996 and found the following average annual rates of CPI change:

2.5% 1.8% 5.9% 6.6% 3.7%, respectively, and we decided to use 3.5%.

Mayor: Go on.

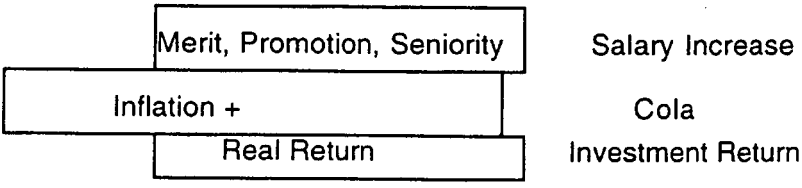
Actuary: The next building block is the salary increase assumption. We assume that salaries of individual employees increase by a general across the board element equal to the inflation assumption and an age/service element intended to reflect merit, promotion and seniority factors.

Mayor: And how did you get your 8.25% investment return assumption?

Actuary: The investment return assumption is based on the formula

Nominal Return=Real Return+Inflation

For each class of assets we have a real return assumption. We obtain an average real return by weighting our assumed real rate for each class of assets (large capitalization stocks, small capitalization stocks, international stocks, corporate bonds, government bonds, real estate, and cash) by its relative market value. Our building block looks like this.



Mayor: Now let's assume your 8.25% assumption is too conservative. What happens to the city's contribution rate if you raise it, by say 1 %?

Actuary: Nothing. We assume that the real rates stay the same and that the inflation assumption is raised. Since your inflation assumption goes up the salary increase assumption produces larger final salaries (and benefits based on them) and the COLA assumption results in larger increases after retirement. If the only change was a 1% increase in the nominal investment return assumption, then the city contribution rate could remain the same, but we certainly wouldn't advocate that.

Mayor: What are other cities of our size and investment policy assuming?

Actuary: The median is 8% and the standard deviation is 1/4% in the surveys we have seen.

Mayor: Let me borrow that Ibbotson book and give me some references on your Actuarial Standards Board and we'll meet in two weeks.

Actuary exits and Mayor receives phone call informing him of a bridge collapse and another call with the threat of the football team leaving unless City builds a new stadium.

Act 2

Two weeks later, Mayor's conference room ,and Mayor is intently scanning books and pamphlets. Actuary I.M. Wright appears and takes a seat.

Mayor: What is your real return assumption for large capitalization U.S. stocks?

Actuary: 6%

Mayor: So your nominal return assumption is *6% + 3.5% = 9.5%.*

Actuary: Yes.

Mayor: Ibbotson shows nominal returns of 1 1.8% for the *30* years ending 1996.

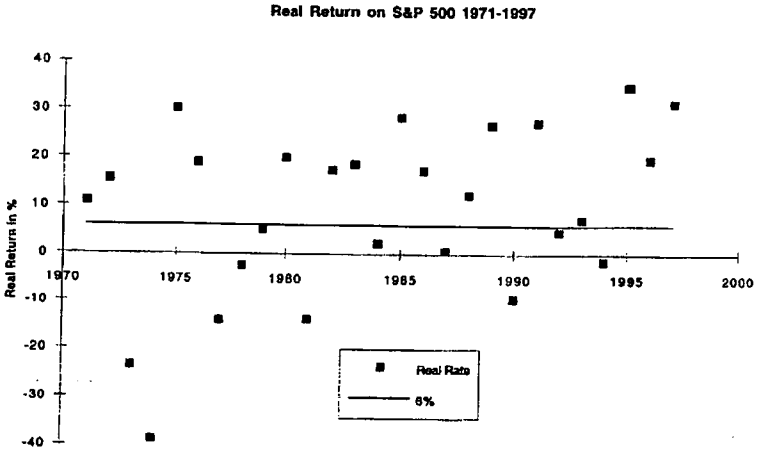
Actuary: The entire period of 72 years ending 1996 shows 10.7%.

Mayor: That period includes the Great Depression, World War II, the Korean and Vietnam conflicts, the cold war, President Nixon's Wage-Price freeze and its aftermath, the oil embargo - do you feel that period is appropriate for future forecasting, given the fall of the USSR and communism in general, the decline of union membership, the efficiencies of the microprocessor and robotics all leading to the overwhelming strength of the U.S. economy? Let's look at the period from December 1970 to the end of 1997. This includes 2 very poor years in the stock market, 1973 and 1974.

Year	CPI Change	S&P 500 Total Return	Real Return	Year	CPI Cl-e	SOP 500 Total Return	Ram Return
1971	3.4	14.3	10.9	1984	4.0	6.3	2.3
1972	3.4	19.0	15.6	19e5	3.8	32.2	28.4
1973	8.8	14.7	-23.5	1986	1.1	18.5	17.4
1974	12.2	-26.5	-38.7	1987	4.4	5.2	0.8
1975	7.0	37.2	30.2	1988	4.4	16.8	12.4
1976	4.8	23.8	19.0	1989	4.6	31.5	26.9
1977	6.8	-7.2	-14.0	1990	6.1	-3.2	-9.3
1978	9.0	6.6	-2.4	1991	3.1	30.5	27.4
1979	13.3	18.4	5.1	1992	2.9	7.7	4.8
1980	12.4	32.4	20.0	1993	2.7	10.0	7.3
1981	8.9	-4.9	-13.8	1994	2.7	1.3	-1.4
1982	3.9	21.4	17.5	1995	2.5	37.4	34.9
1983	3.8	22.5	18.7	1996	3.3	23.1	19.8
				1997E	1.7	33.2	31.5

The geometric mean of these nominal returns is 13.3% and the arithmetic mean is 14.5 % What is more interesting is the standard deviation, 16.5 %. How do you actuaries handle such enormous variation in asset values?

Actuary: We smooth the fluctuations, using, in your case, a rolling five year amortization of the difference between expected values and actual values.



Mayor: Sounds sensible. Now look at the real rates of return, varying from +34.9 % to -38.7 % - does your 6 % assumption jump off the page?

Actuary: muffled, inaudible response.

Mayor: Now lets look at your formula for the nominal return

Nominal Return=Real Return+Inflation

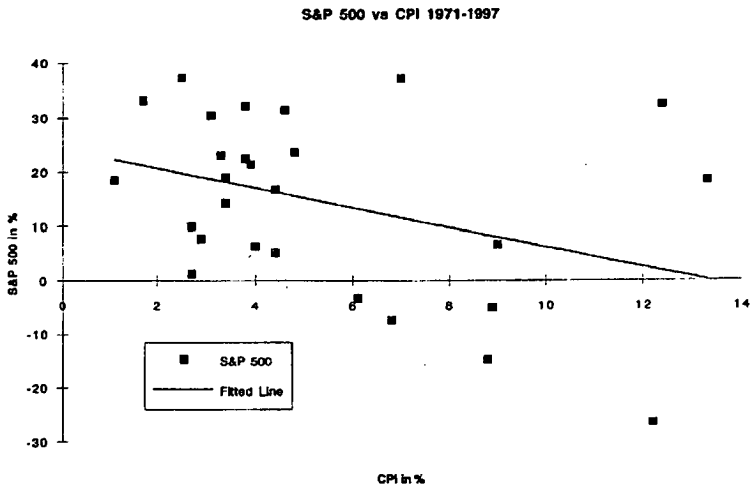
The key arithmetic expression is the plus sign: the clear implication is cause and effect - if inflation goes up, the nominal rate goes up since investors expect a return to compensate them for the loss of purchasing power.

Actuary: Yes, that's correct.

Mayor: Lets look at the correlation between the two series. The correlation

coefficient is minus 36.9%. That means that stocks go up if inflation goes down! Seems that's what Federal Reserve Chairman Greenspan has been saying. He won't raise interest rates as long as inflation is moderate and the stock market likes it because corporate earnings are up if interest costs are low.

S&P 500 ve CPI 1971-1997



Actuary: Interesting, but not true in the past.

Mayor: Wrong, Ibbotson shows the correlation between large company stocks and inflation to be minus 2% for the 77 year period. Essentially no correlation.

Actuary: But there is correlation between bond yields and inflation!

Mayor: Only a 41% positive correlation between treasury bill yields and inflation - all other corporate and government bonds in the Ibbotson data show no correlation or negative correlation.

Actuary: I can feel the underpinnings of the building block approach sliding. The Actuarial Standards Board gave us two acceptable methods, the building block and the discounted cash flow. The latter method is rarely used in the US and wouldn't be feasible for common stock portfolios that are rapidly traded.

Mayor: There is a third method: any method that the actuary can justify. Why don't you develop one - perhaps start with corporate earnings? In the long run, stock prices follow corporate earnings.

Actuary: We have always worked with inflation and don't know much about corporate earnings.

Mayor: That reminds me of the guy who lost his watch in the woods, but was looking for it under the lamppost because the light was better! Incidently your salary increase approach no longer fits the nature of pay plans in the 1 990's. These plans now include incentive pay that is in the form of bonuses which are not rolled up into the salary base and which might not be included in final pay used for pension calculation. Seniority is far less important. The building block method is wonderful in theory, but doesn't fit the facts.

Mayor: Now how is it that the actuaries of the plans in your survey have a standard deviation of 1/4% in their assumptions, while common stock returns have such an enormous variation? Your Pension Section Chair of the Actuarial Standards Board has said that the purpose of the standard is to diminish reliance on the work of other actuaries.

Actuary: The standard took 5 years to bring out and there are lots of unresolved issues. My assumptions have a margin of conservatism - you don't want a 50% chance of being wrong, do you?

Mayor: As I read the standard you are supposed to develop a "best estimate range" for each assumption. The range is interpreted as the 25th to 75th percentile. Equities, in the latest survey I saw, account for 60% of investments of public employee plans and 70% in the case of corporate plans. This was before the run up of equity prices in the last 3 years. It seems to me that there is a pretty wide range in the case of common stock returns and your single-point estimate is quite conservative. I think it is up to the plan sponsor to balance the needs of current taxpayers and employees and future taxpayers and employees in selecting the assumption.

The curtain closes as the Actuary picks up his briefcase.

Act 3

The scene takes place in the Executive Dining Room of Megabank in the 47th floor of Megabank Tower. At the table are Mayor Trustbutverify, Actuary I.M. Wright wearing a Megabank lapel pin and an unidentified man wearing Ferragamo shoes and a Sulka tie. They are being served by a waiter wearing white gloves.

Actuary: Mr. Mayor I'd like to introduce you to Charles J. Bondseller, of Megabank's investment banking department.

Bondseller: It's a pleasure. Have another helping of caviar; we have it specially shipped In from Iran.

Mayor: Thanks, don't mind if I do. Now why are we here?

Actuary: Our actuarial firm was sold by our previous owners, a public utility, to Megabank and we are engaging in cross-selling. Charles has something that might save your city a lot of money.

Bondseller: Yes, the State has passed legislation allowing the City to sell municipal bonds to fully fund the unfunded pension liability. We can issue the bonds at about 7.5% taxable and then you can invest the proceeds in common stocks with our investment management people and earn about 11% total return. A cool profit of 3.5% and no investment.

Mayor: What if we don't earn 7.5%, are we on the hook to pay the interest?

Bondseller: Yes, but we are very confident you can earn 1 1% on the stocks we pick.

Mayor: And Mr. Actuary, are you just as confident?

Actuary:
(the balance of the manuscript has been lost - the reader is invited to complete the play)