Chapter 7 Answers.

Below is a description of the current State Teacher Retirement System of Ohio pension benefit.

**STRA Salary-related benefit**

The annual salary-related benefit (a life annuity at retirement) is calculated by multiplying your first 30 years of service credit by 2.2% of the final average salary (average of your three highest years of Ohio public earnings).

The 31st year of contributing service credit is multiplied by 2.5% of the final average salary. An additional one-tenth of a percent is added to the calculation for every year of contributing service over 31 years (2.6% for the 32nd year, 2.7% for the 33rd year and so on) until 100% of the final average salary is reached.

Consider a person with 30 years of service at age 55 and a final average salary of $100,000. Assume life expectancy of 85.

Assuming that final average salary does not change and an interest rate of 0%, how does postponing retirement from age 55 to age 56 affect:

a. the PV of the pension benefit (give a numerical value and show your calculation).

   *At age 55, the person’s annual benefit would be 30*.022*100,000=$66,000. The PV of $66,000 for 30 remaining years of life is $66,000*30=$1,980,000.*

   *At age 56, the person’s annual benefit would be (30*.022+.025)*100,000=68,500. The PV of $68,500 for 29 remaining years of life is $68,500*29=1,986,500.*

   *Consequently, postponing retirement from age 55 to 56 increases the PV of pension benefits by $6,500.*

b. the PV of lifetime earnings (give a numerical value and show your calculation).

   *At age 55 retirement, the PV of the person’s remaining lifetime earnings would be 0.*

   *At age 56 retirement, the PV of the person’s remaining life earnings would be $100,000.*

   *The increase in the PV of lifetime earnings from postponing retirement from age 55 to age 56 is $100,000.*

When Professor Even arrived at Miami University, all years were credited with 2% (not 2.2% as now) per year of service. The credit did not increase beyond age 30.
c. For the person described above, draw budget constraints for a retirement age that begins at age 55 and may be as high as 75 for the “new” and “old” systems without providing numerical detail.

![Diagram of PV of Lifetime Income for new and old systems]

PV of Lifetime Income

old

new

75 Retirement age 55


d. For a person that retired at age 55 under the old program, is it possible to say whether the change would be more likely to cause an earlier or later retirement date? Explain with reference to income and/or substitution effects (no need to draw more diagrams ... just provide a verbal description of each effect).

At age 55, the new system generates higher benefits (2.2*30 instead of 2.0*30) and it generates larger increment in benefits for postponing retirement by a year (2.5% for an additional year instead of 2.0). The former effect shifts the budget constraint up, the latter effect steepens the budget constraint. The effect on retirement age is ambiguous. The wealth effect is that the person has greater wealth under the new plan at age 55 and would retire sooner. The substitution effect is that the monetary reward for retiring later has increased so the person retires later.

e. An important complication that we have not discussed in our analysis of pension benefit formulas is that postponing retirement by a year will affect the “final average salary” which is based on the highest three years of earnings. Given that higher inflation is generally associated with higher nominal wage growth, how would the slow down of inflation that has occurred over the past few decades affect the incentive to retire? Explain by describing the effect on the budget constraints you drew above.
During periods of high inflation, nominal earnings growth is higher and a person's final average salary will increase more when retirement is postponed. As a consequence, during less inflationary times, the increase in the annual benefit from postponing retirement is smaller, the lifetime budget constraint becomes flatter, and the substitution effect is to retire sooner.

f. Explain how the recent switch to defined contribution plans would affect the incentive to retire.

In defined benefit plans, a benefit is paid from retirement age until death. The PV of benefits will eventually diminish as retirement is postponed because the number of years that the person collects benefits drops. In defined contribution plans, the person receives a lump sum upon retirement that is equal to the compounded value of all contributions. The PV of a DC plan can only grow as a person postpones retirement. Consequently, the financial reward to postponing retirement is greater in a DC than a DB plan and, assuming no wealth effects, people will retire later.

2. Under the current Social Security system, if you retire at age 62, you will receive 80 percent of the "full" Social Security benefit that you could receive if you wait until age 65. If you postpone retirement from age 62 to 63, your Social Security check would increase from 80 to 87% of the full benefit.

a. (5 points) Assuming a zero percent interest rate and life expectancy of age 80, is Social Security providing more or less than the "actuarially" fair increment in benefits? To justify your answer, indicate what the actuarially fair adjustment is (ASSUME 0% INTEREST IN YOUR CALCULATION.)

Since the worker gives up 80% of salary for postponing retirement a year, the actuarially fair increment would have to "make-up" for this by just enough over the remaining 17 years to make up for this loss. That is, if \(X \) is the actuarially fair adjustment, \(17 \times x = 80\), or \(x = 4.7\). That is, an actuarially fair adjustment for postponing retirement from age 65 to 63 would be an extra 4.7% of the full benefit. Since the system provides an extra 7% for postponing retirement (80 to 87 percent of full benefit), it provides more than the actuarially fair increment.

b. (5 points) Suppose that the Social Security formula was changed so that the benefit for retirement at age 62 is only 70% of that received at age 65, and the benefit at age 63 is 80% of that received at age 65. If the lifetime budget constraint under the "old" system is given below, demonstrate the effect of switching to this "new" program (no numeric detail required .. just show the change affects the relative position of the budget constraints). Note that at age 65, the
old and new system provide the same benefit.

![Graph showing Retirement Age with NEW BUDGET LINE](image)

5. (5 points) If someone previously retired at age 63 under the "old" system, will the change described above likely lead to earlier or later retirement? Explain by pointing out the direction of any income or substitution effect of the change.

*At age 63, the new plan will generate a lower level of lifetime income. Consequently, the income effect of the change is that people will retire later.*

*At age 63, the reward for postponing retirement has increased (i.e. the budget constraint became steeper), so the substitution effect is that people will retire later.*

*Both the income and substitution effect encourage later retirement.*