Introduction to Finance

Problem Set 2

Question 1

You expect to have $8,000 in one year. A bank is offering loans at 4.5% interest per year. How much can you borrow today?

Question 2

Qualcomm has developed a groundbreaking new CPU chip. The patent on the chip will last 17 years. You expect the chip's profits to be $4 million in its first year and this amount to grow at 5% per year over the patent's 17-year life. Once the patent expires, Intel will be able to produce the same chip and competition will likely drive profits to zero. What is the present value of the new chip if the interest rate is 8% per year?

Question 3

Assume that Social Security promises you $50,000 per year starting when you retire 45 years from today (the first $50,000 will be paid 45 years from now). If your discount rate is 4%, compounded annually, and you plan to live for 17 years after retiring (so that you will receive 18 payments including the first one), what is the value today of Social Security's promise?

Question 4

Consider the following three stocks.

- Stock A is expected to provide a dividend of $10 per share forever.
- Stock B is expected to pay a dividend of $5 next year. Dividend growth is expected to be 4% per year forever.
- Stock C is expected to pay a dividend of $5 next year. The dividend is expected to grow by 20% annually for 5 years (i.e., until year 6) and then pay no dividend forever.

If the discount rate for each stock is 10%, which stock is the most valuable?

Question 5

Your cousin is currently 13 years old and will go to college in 5 years. Your aunt and uncle would like to have $95,000 in a savings account to fund her education at that time. If the account promises a fixed interest rate of 3.7% per year, how much money must they put into the account today?

Question 6

(Adapted from Catherine et al. 2020 and Sabelhaus and Volz 2020) Suppose you earn the median household income in Paris (€27,180) and have just turned 20. You intend to work until age 62 and expect your salary to increase with inflation (2%). Assume you are paid at the end of each year of age, from the end of age 20 through the end of age 61. At retirement, you receive a Social Security payment equal to 60% of your last wage, growing thereafter with a 1% price adjustment. You know for certain that you will live until age 100 and want to compute the present value of your human capital and transfer income.

- a. Computing human capital. Suppose your labor income is as risky as the stock market, which has a required return of 10%. What is the present value of your labor income at age 20, given that it grows with inflation?
- b. Riskless Social Security. You receive your first Social Security payment at age 62. Suppose Social Security is discounted at a risk-free rate of 3%. What is the value of Social Security wealth now (at age 20)?
- c. Risky Social Security. Another group of economists argues that Social Security is risky and should be discounted at 10%. Repeat the analysis under this assumption.
- d. Comparison. Compare total wealth (Social Security + human capital) under both cases. Which is larger, why, and what is the economic significance?