

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 that the chip's profits to be \$4 million in its first year and that this amount will grow at a rate of 5% per year for the next 17 years. 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 get 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 a total of 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 a share forever.
- Stock B is expected to pay a dividend of \$5 next year. The 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. She will be going 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 to pay a fixed interest rate of 3.7% per year, how much money do they need to put into the account today to ensure that they will have \$95,000 in 5 years?

Question 6

(Adapted from Catherine et al. 2020 and Sabelhaus and Volz 2020) Suppose that you are earning the salary of a median household in Paris (27180 euros) and you just turned the age of 20. You intend to work until 62 and expect your salary to increase by inflation (2%). Assume that you're paid at the end of every age year (end of 20 to end of 61). At retirement, you are paid a Social Security payment equal to the 60% of your last wage and grows with a 1% price adjustment. You know for certain that you'll live until age 100 and want to compute the current present value of your human capital and transfer income.

- a. *Computing human capital.* Suppose that your labor income is equally risky to the stock market, which has a required rate of return of 10%. What is the present value of your labor income at age 20 given that it grows by inflation?
- b. *Riskless Social Security.* You receive your first Social Security payment at 62. Suppose that Social Security is discounted at a risk-free rate of 3%. What is the value of the Social Security wealth now (at age 20s)?
- c. *Risky Social Security.* Another group of economists tell you that Social Security is risky and should be discounted at the risky rate (10%): repeat the analysis under this assumption.
- d. *Comparison.* Comment on the total wealth (Social Security + Human Capital) under both cases: which is larger? Why? What is the economic significance here?