

Introduction to Finance

Problem Set 1

Question 1

You expect to have \$7,550 in one year. A bank is offering loans at 3.5% interest per year. How much can you borrow today?

Question 2

A company has developed a new technology that will be protected by a patent during 15 years.

The profits are expected to be \$2 million for the first year, and they will then grow by 6% each year. Once the patent expires, the competitors will be able to use the technology and competition will likely drive profits to zero.

What is the present value of this new technology if the interest rate is 7% per year?

Question 3

A retirement fund proposes you 45,000 annually starting at the time of your retirement in 40 years (the first 45,000 will get paid 40 years from now).

You believe that you will live 20 years after retiring (you will receive a total of 21 payments including the first one). If your discount rate is 5%, what is the value today of this 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

Consider an American student that is currently 13 years old (entering college in 5 years). How much money does she need to have into an account today to ensure that she will have \$105,000 (assumed cost of education) in 5 years if the interest rate is fixed to 4.2% each year?

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 67. 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 20)?
- 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?