Chapter 2: Fundamental concepts and techniques

Exercises

1. People with a background in science and technology often complain that short-sighted economists reject visionary technology projects that will produce large benefits in the (far) future. Discuss this matter from a financial point of view using some numerical illustrations.

2. Your tennis club needs to replace the gravel of its courts every seventh year. To pay for the operation the club organizes a fancy fair every year, starting now. Replacing the gravel costs €35 000 and the interest rate is 7%. How much does the fancy fair have to bring in each year to produce the necessary €35 000 in seven years?

3. An oil company in the Middle East organized a competition for the best business plan for one of its obsolete refineries. Your student team participated with a plan for a chemistry theme park and won the first prize, which offers you the following choices:

   (a) an amount now of 300 000 AED (United Arab Emirates dirham, the currency of the United Arab Emirates, €1≈5.10 AED)
   (b) 425 000 AED under the festive opening of your project, four years from now
   (c) a scholarship of 65 000 AED per year for 6 years, the first payment is now, to finish your study and get a PhD from a famous university in the middle of Norway
   (d) a yearly payment of 30 000 AED for ever, the first payment is now

   The interest in AED is 10% per year and there is a well functioning financial market. Which of the alternatives has the highest value? What is your answer if the interest rate is 12.5%?

4. ZXco is considering the development of a new product line. The project requires an investment now of €350 million and will generate income for 4 years, starting one year from now. The income amounts are €300, €400, €450 and €350 millions and the corresponding production cost will be €150, €175, €200 and €150 millions for these 4 years, operating costs will be €50, €75, €65, €60 millions. The investment is linearly depreciated (in equal amounts every year) and it is worthless at the end of the fourth year. The project also requires working capital; the necessary amounts are €20 now and €35, €50, €60 millions in the following three years. The working capital will be liquidated in the final year of operation. The tax rate is 28% and ZXco calculated the cost of capital for the project at 10%.

   (a) Should ZXco accept the project or not? Support your answer with calculations and make additional assumptions if necessary.
   (b) What is the project's internal rate of return?

5. Over the interval $W = 0$ to $W = 70$, person A has the utility function $U_A = 3W - .02W^2$ and person B has the utility function $U_B = 2W - .01W^2$. Which of the two is more risk averse, A or B?

6. The locus of the productive optimum in Figure 1 depends on the slope of the budget line. How does the budget line change if the interest rate is higher? Are more or less projects taken into production?

7. How does individual 1 in Figure 1 reach his optimal consumption pattern of B02 in t_0 and B12 in t_1?

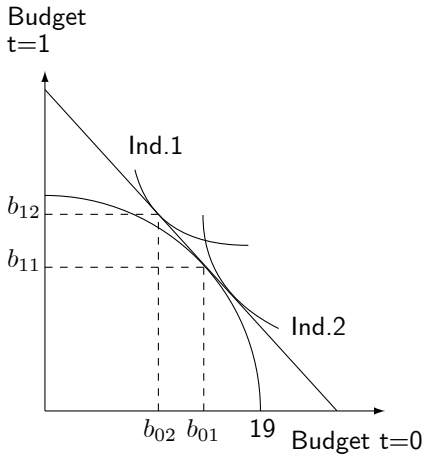

Figure 1: Production and consumption choices

8. A somewhat challenging exercise to illustrate the diversification effect in a portfolio of loans. Assume that all loans are of equal size, that each loan pays 10% interest and has a 4% probability of default. Defaults are independent events and when they occur the entire loan is lost. So an individual making one such loan has a 96% chance of earning 10% and a 4% chance of losing all his or her money. Suppose a bank holds a portfolio of 100 such loans.

   (a) What is the probability that the bank loses all its money, i.e. that all loans default?

   (b) How many loans in the bank's portfolio have to default in order for the bank to break even, i.e. that the interest income is just enough to cover the losses from defaults?

   (c) What is the probability that the bank will at least break even, i.e. that the number of defaults will be less than the number you calculated under (b)? Use the table in the appendices of Chapter 8 and the normal approximation of the binomial distribution, with mean $\mu = n \times p$ and standard deviation $\sigma = \sqrt{n \times p \times (1-p)}$ where n is the number of binomial trials (=loans) and p is the binomial probability (=probability of default).