

Planning short-term financing

Companies regularly address the challenge of financing short-term cash commitments. Linear programming is an effective tool for determining the optimal combination of financial instruments to meet these commitments. In this project, we will explore linear programming tools.

The following table shows the cash flows (balance of all cash operations), in thousands of euros, forecast for each of the next six months.

| Month | Jan | Feb | Mar | Apr | May | Jun |
|-----------|------|------|-----|------|-----|------|
| Cash flow | -100 | -200 | 100 | -150 | 550 | -100 |

A negative cash flow makes it necessary to resort to financing. The company has the following financing options:

- A credit line of up to 100 000 euros per month at an interest rate of 1% per month.
- In either of the first two months, it can issue 3-month commercial paper at a total interest rate of 2% for the 3-month period.

The excess funds can be invested at an interest rate of 0.1% per month. The company wants to determine the optimal financing and investment plan that maximises cash flow at the end of the six-month period.

1. Model the problem in linear programming. Carefully define all the variables and explain all the constraints.
2. Using software that solves Linear Programming problems, obtain the optimal financing plan. Attach the code used to solve the problem. Present the solution, including the values of the slack variables.
3. Write the dual of the given problem and present (justifying) the optimal solution of the dual, including the values of the slack variables.
4. Economically interpret the optimal solution obtained (considering the primal and dual solution).
5. Indicate, with justification, whether the credit line limit of 100 000 euros per month restricts the solution found. If so, explain the impact of this constraint on the solution.
6. Compare, using the values of the shadow prices, the impact on the final value of the objective function of each unit required in the months with negative cash flow. Justify this using terms of marginal variations.
7. Create your own data set of the cash flows, in thousands of euros, for the next twelve months of a certain company and answer all the previous questions. Adjust the questions and data as needed.

Write a report (maximum five pages) with your answers. The report must be accurate, clear and simple.