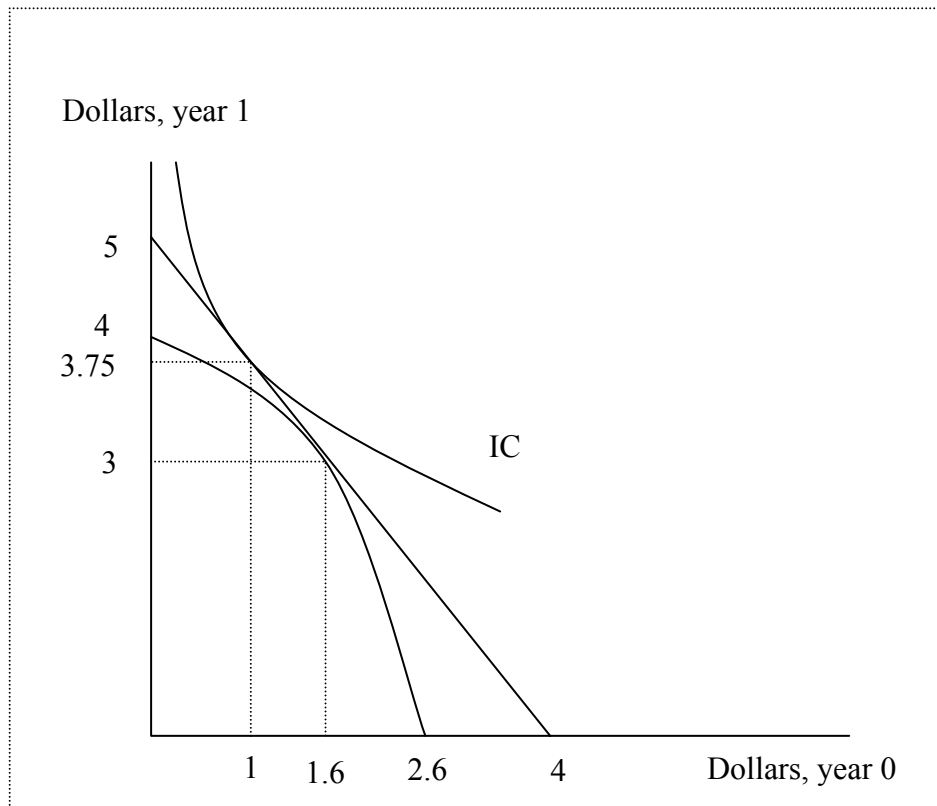


Econ 422
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Summer 2004
Midterm Exam

This is a closed book exam. However, you are allowed one page of notes (double-sided). Answer all questions. For the numerical problems, if you make a computational error you may still receive full credit if you provide the correct formula for the problem. There are 25 questions, and each question is worth 4 points. Total points = 100. You have 2 hours to complete the exam. Good luck.

I. Intertemporal Consumption and Investment Decisions (32 points)

In the figure below, the downward sloping straight line connecting the points (0,5) and (4,0) represents the opportunities for investment in the capital market (money market), and the downward sloping curved line connecting the points (0,4) and (2.6,0) represents the opportunities for investment in physical capital (e.g. plant and machinery). The only asset at time 0 is \$2.6 million in cash (initial endowment). There is no additional endowment present at time 1.



Please answer the following questions related to the figure:

- a. What is the interest rate, r ?
- b. How much should be invested in physical capital (plant and equipment)?
- c. How much will this investment be worth next year?
- d. What is the total rate of return on the optimal investment in physical capital?
- e. What is the marginal rate of return on the optimal investment in physical capital?
- f. What is the present value (PV) and net present value (NPV) of this investment?
- g. What is the optimal consumption at times 0 and 1?
- h. How much is borrowed or lent at time 0?

II. Present Value Computations

1. For an investment of \$1000 today, the Washington State Employees Credit Union is offering to pay you \$1600 at the end of 8 years. (12 points)

- a. What is the annually compounded rate of interest?
- b. What is the semi-annually compounded rate of interest (expressed as an annual rate)?
- c. What is the continuously compounded rate of interest (expressed as an annual rate)?

2. Suppose Washington Mutual grants you a \$300,000, 30 year mortgage with a fixed annual interest rate of 10%. (12 points)

- a. Assuming the mortgage requires monthly payments, what is the monthly payment amount? (Hint: from Washington Mutual's point of view, \$300,000 is the PV of a stream of $12 \times 30 = 360$ fixed monthly cash flows)
- b. Suppose interest rates fall to 5% right after the mortgage contract is signed. Determine the present value of the mortgage with the new interest rate. Note: this is the amount that Washington Mutual can sell the mortgage for in the secondary loan market.
- c. Who benefits from the fall in mortgage rates – you or Washington mutual? Briefly explain.

III. Bond Pricing and the Term Structure of Interest Rates (16 points)

The current yield curve for default-free pure discount bonds (zero coupon bonds) for maturities up to 3 years is as follows:

Maturity (years)	Spot rate
1	10%
2	11%
3	12%

Assume all bonds have a face value of \$100. Please answer the following questions:

- What are the implied 1-year forward rates, ${}_t f_t$, for $t=2, 3$?
- Assume that the expectations hypothesis of the term structure is correct. If market expectations are accurate, what will the term structure, that is, spot rates on 1 and 2 year pure discount bonds, be next year? (Note: I am asking you to determine the spot rates ${}_1 r_2$ and ${}_1 r_3$. The latter rate is the spot rate 1 year from today for investing in a 2 year zero coupon bond.)
- Using the spot rates, compute the current price of a 12% coupon bond maturing in 3 years. Assume annual coupon payments and a face value of \$100. (Hint: what are the cash flows on the coupon bond?)
- For the coupon bond in the previous question, give an equation that defines the yield-to-maturity on the bond. Do not attempt to solve the equation!

IV. Valuing Stocks (8 points)

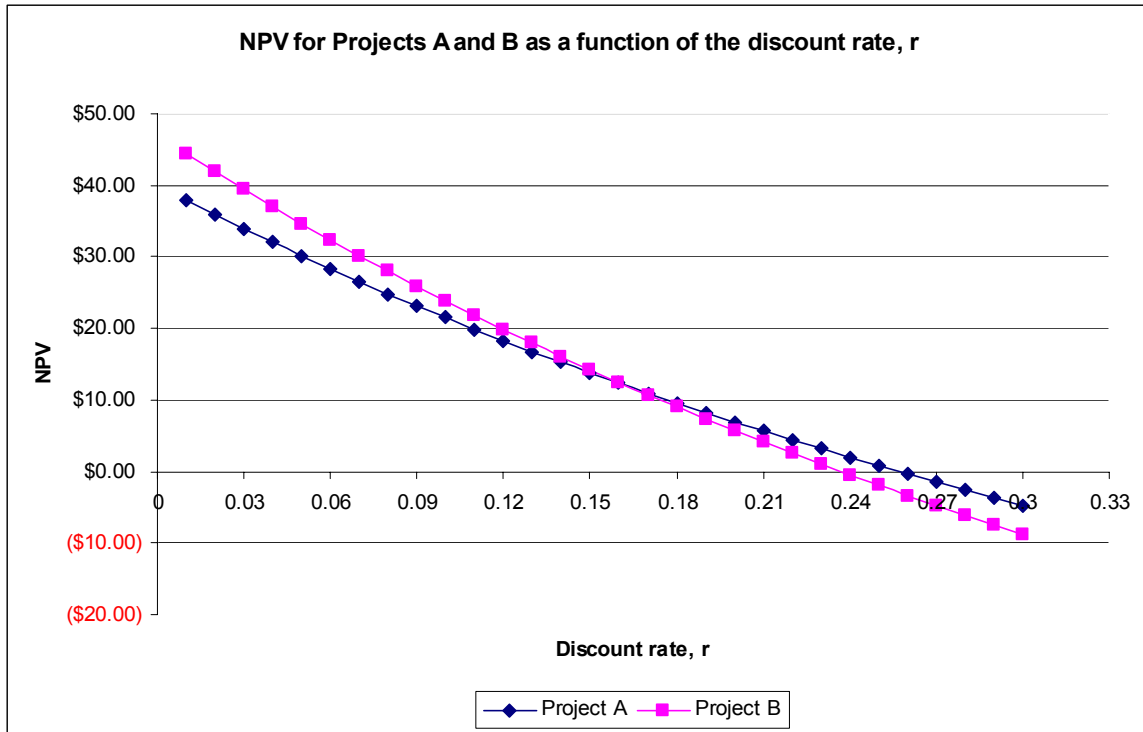
- A company's dividends per share are expected to grow indefinitely by 3% per year. If next year's dividend is \$1 and the market capitalization rate is 7%, what is the current stock price?
- Continuing with the previous question, suppose that the dividend growth rate suddenly increases to 3.1% per year. What is the percentage change in the stock price that results from this change in the dividend growth rate?

V. The NPV and IRR Rules for Investment Analysis (20 points)

Consider two mutually exclusive projects called project A and project B, with the following cash flows:

Project/Time	0	1	2
A	-100	70	70
B	-120	70	97

The net present values of the projects, as a function of the discount rate r , are plotted in the figure below.



Please answer the following questions:

- What is the net present value (NPV) rule for accepting a project? What is the NPV rule for ranking mutually exclusive projects?
- What is the internal rate of return (IRR) rule for accepting a project? What is the IRR rule for ranking mutually exclusive projects?
- Based on the figure, approximately what are the IRRs for projects A and B?
- If the discount rate is $r = 6\%$, which project is chosen by the NPV rule and which project is chosen by the IRR rule?
- If the discount rate is $r = 22\%$, which project is chosen by the NPV rule and which project is chosen by the IRR rule?