Lecture 16. Interpreting financial narratives.

FOR 2022. Financial Analysis for Natural Resources.

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Problem One:

In the year 2000, you inherited an old house from your grandfather and found a block of 100 shares of common stock in Pere Marquette Railroad Company, hidden in a wall safe. The stocks (100 shares) are dated 1911 and for an investment of $227.50. You find out that Pere Marquette was purchased by Chesapeake and Ohio Railroad Company in 1951, but the company will honor the stock certificates. The C&O informs you that the value of the Pere Marquette stock is currently $398.50 per share. What was the average annual earning rate for the investment your grandfather made?

- Do you know the present value, future value, payment amount, or interest rate? For which of these are you trying to solve?
  - Initial value (V_0) is $2.275 per share or $227.50 for 100 shares
  - Future value (V_n) is $398.50 per share or $39,850 for 100 shares
- What information is missing that are you trying to find?
  - The interest rate at which the initial investment grew.
- Was there a single payment or a series of payments?
  - A single payment was made in 1911
- How many discount periods are there?
  - Number of payments 1911 to 2000 is 89 years! (n = 89)
- What equation works?
  - Earning rate

$$i = \left[\sqrt[n]{\frac{V_n}{V_0}} - 1\right]100 \quad = \left[\sqrt[89]{\frac{\$39{,}850}{\$227.50}} - 1\right]100 = 5.98\%$$

Problem Two:

You are considering investing in 401K retirement fund. The fund manager says that your rate of return on all payments into the fund should average 12% annual interest, compounded monthly. If you invest $500 every six months in this fund for 43 years, how much will your account balance be when you retire?

- Do you know the present value, future value, payment amount, or interest rate? For which of these are you trying to solve?
  - Interest rate is 12% annual, compounded monthly or 1% per month.
  - The payment made is $500 at the end of every six months.
- What information is missing that are you trying to find?
  - The future value of the retirement fund.
- Was there a single payment or a series of payments?
  - Payments are made every 6 months for 43 years, or 86 payments
- How many discount periods are there?
  - There are 6 discount periods between payments
- What equation works?
  - Future value of a terminating series of periodic payments.

$$V_n = a\frac{(1+i)^{w\times t}-1}{(1+i)^t-1} \qquad = \$500\frac{(1.01)^{86x6}-1}{(1.01)^6-1} = \$1{,}371{,}562$$

Problem Three:

You have a picnic shelter that has a replacement cost of $50,000 and an expected lifespan of 20 years. If the Park Service can invest income at 5%, how much should be collected annually in user fees so that the shelter can be replaced when its useful life is over?

- Do you know the present value, future value, payment amount, or interest rate? For which of these are you trying to solve?
  - Interest rate is 5% per year
  - We know the replacement cost, or future value is $50,000
- What information is missing that are you trying to find?
  - The annual payment required to save at 5% to have $50,000 in 20 years.
- Was there a single payment or a series of payments?
  - A series of payments (savings of user fees) are made each year.
- How many discount periods are there?
  - There are 20 discount periods.
- What equation works?
  - Sinking fund equation:

$$A = V_n\frac{i}{(1+i)^n-1} \qquad = \$50{,}00\frac{0.05}{(1.05)^{20}-1} = \$1{,}512$$

Problem Four:

You have rental income on a field from a farmer who pays you $1825 per year. If your cost of capital is 5%, what is the value of this field to you today?

- Do you know the present value, future value, payment amount, or interest rate? For which of these are you trying to solve?
  - Interest rate is 5% per year
  - Payment amount is $1825 per year.
- What information is missing that are you trying to find?
  - The maximum value of this field in present value terms?
- Was there a single payment or a series of payments?
  - A series of payments, each year. We can assume, from the wording that the series is perpetual since no ending date is mentioned.
- How many discount periods are there?
  - There are an infinite number of discount periods.
- What equation works?
  - Present value of a perpetual annual series:

$$V_0 = \frac{a}{i} \qquad = \frac{\$1825}{0.05} = \$36{,}500$$

Problem Five:

You buy a tractor for $12,500 and agree to pay Capital Equipment of Little Rock for the tractor over 48 months. They have quoted you an interest rate of 4.8% annual interest, compounded monthly. What will your payments be?

- Do you know the present value, future value, payment amount, or interest rate? For which of these are you trying to solve?
  - Interest rate is 4.8% per year, compounded monthly, so .048/12 = 0.004 / month
  - You know the present value (V_0) is $12,500
- What information is missing that are you trying to find?
  - The payment amount to recover the initial capital of $12,500
- Was there a single payment or a series of payments?
  - A series of payments, each month.
- How many discount periods are there?
  - There are 48 payments to be made.
- What equation works?
  - Capital recovery equation:

$$A = V_0 \frac{i(1+i)^n}{(1+i)^n - 1} \qquad = \$12{,}500 \frac{0.004(1.004)^{48}}{(1.004)^{48} - 1} = \$286.74$$

Problem Six:

You own a 40-acre cutover pine plantation. You pay $5145 for site preparation and planting this year. You pay $1520 next year for herbicide treatment. Twenty years from now you have a pulpwood harvest that has net returns of $8500. Thirty years from now you clearfell the stand and have net returns of $125,000. Assuming you can reinvest your pulpwood harvest in other, similar forestry projects, what is your rate of return?

- Do you know the present value, future value, payment amount, or interest rate? For which of these are you trying to solve?
  - We know future value of all costs and returns
  - We do NOT know any interest rate!
- What information is missing that are you trying to find?
  - The rate of return for this project. This will be the interest rate that makes NPV of the project go to zero.
- Was there a single payment or a series of payments?
  - There are multiple, single payments.
- How many discount periods are there?
  - Over the project, there are 30 discount periods, with each cash flow occuring at a different time.
- What equation works?
  - Present value equation works, must be applied many times to find internal rate of return.
  - Can use IRR because intermediate cash flows can be invested in similar projects which should have the same internal rate of return as this project!

$$V_0 = V_n(1+i)^{-n}$$

Solution on next page

Answer to problem six…

Year	Cash Flow	4%	8%	12%	10%	11%
0	($5,145)	($5,145)	($5,145)	($5,145)	($5,145)	($5,145)
1	($1,520)	($1,462)	($1,407)	($1,357)	($1,382)	($1,369)
20	$8,500	$3,879	$1,824	$881	$1,263	$1,054
30	$125,000	$38,540	$12,422	$4,172	$7,164	$5,460
	NPV =	$35,813	$7,693	($1,449)	$1,900	$0

IRR is the interest rate that drives NPV = 0
IRR = 11%

Next lecture…

Benefit / cost ratio…