

What is Internal Rate of Return (IRR)?

Worksheet

IRR is the break-even discount rate where NPV = 0. For a single-cash-flow investment, $IRR = \left(\frac{\text{Future cash flow}}{\text{Initial investment}} \right)^{\frac{1}{n}} - 1$.

$$\sum_{t=0}^n \frac{CF_t}{(1+IRR)^t} = 0$$

Questions

1. IRR is defined as the discount rate where

- A) NPV is maximized
- B) NPV equals zero
- C) cash flows are largest
- D) the payback period ends

2. A project has an IRR of 14% and the company's cost of capital is 10%. What should the company do?

- A) Reject the project
- B) Accept the project
- C) Wait and see
- D) IRR is irrelevant here

3. \$10,000 today grows to \$20,000 in 5 years. Approximately what is the IRR?

- A) 100%
- B) 20%
- C) 14.87%
- D) 5%

4. Why can IRR be hard to calculate for multi-year, uneven cash flows?

- A) It never has a solution
- B) It typically requires solving iteratively (trial and error or software)
- C) IRR does not exist for such projects
- D) It can be found using simple algebra

5. You invest \$10,000 today and expect to receive \$20,000 in 5 years. What is the IRR?

6. An investment of \$5,000 grows to \$15,000 in 8 years. Find the IRR.

7. \$100,000 invested today returns \$250,000 in 10 years. What is the IRR?

8. Define: What is IRR?

9. Define: What is the decision rule for IRR?

10. Define: How is IRR related to NPV?

Answer Key

1. B) NPV equals zero - By definition, IRR sets NPV to zero.
2. B) Accept the project - IRR (14%) exceeds the required return (10%), so the project is worth accepting.
3. C) 14.87% - $IRR = (20,000/10,000)^{1/5} - 1 = 14.87\%$.
4. B) It typically requires solving iteratively (trial and error or software) - With irregular cash flows the equation isn't solvable in closed form, so analysts iterate to find the rate.
5. $IRR = (CF/C_0)^{1/n} - 1$ $IRR = (20,000/10,000)^{1/5} - 1 = 14.87\%$
6. $IRR = (15,000/5,000)^{1/8} - 1$ $IRR = 3^{0.125} - 1 = 14.72\%$
7. $IRR = (250,000/100,000)^{1/10} - 1$ $IRR = 2.5^{0.1} - 1 = 9.60\%$
8. The discount rate at which a project's NPV equals zero - the project's expected annualized rate of return.
9. Accept the project if IRR exceeds the company's required rate of return (cost of capital).
10. IRR is the rate where the NPV curve crosses zero on an NPV-vs-discount-rate graph.

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