

Corporate Finance, Module 4, "Net Present Value vs Other Valuation Models"

Four IRR Pitfalls

(The attached PDF file has better formatting.)

Pitfall 1 (on borrowing and lending) and pitfall 3 (on mutually exclusive projects) are important. The term *pitfall* is not ideal. Borrowing and lending have the same IRR, but the opposite acceptance criterion. If Jonathan lends money to David, and Jonathan's IRR is 12%, David's IRR is 12%.

- If the market interest rate for loans of this quality is 10%, Jonathan has a positive NPV project and David has a negative NPV project. One should *lend* if the IRR exceeds the opportunity cost of capital.
- If the market interest rate for loans of this quality is 15%, Jonathan has a negative NPV project and David has a positive NPV project. One should *borrow* if the IRR is less than the opportunity cost of capital.

Question: Higher quality borrowers get loans at lower rates. Are loans by higher quality borrowers generally positive NPV projects and loans by lower quality borrowers negative NPV projects?

Answer: The market interest rate is the rate for that quality of borrower. Both the high interest rate loan and the low interest rate loan may have a zero NPV.

Question: Do loans ever have a positive NPV?

Answer: A positive NPV loan stems from a supplier that wants to increase sales or a foreign government that wants to improve its trade balance. A supplier's goods may be no better than those its competitors, and the purchase of the good is a zero NPV project. But if the supplier (or the supplier's government) offers a subsidized loan, the total NPV for the borrower may be positive. We discuss this in later modules, where the emphasis is on the tax shields from the subsidized loan.

Question: Pitfall 2 seems serious. If an IRR model has multiple possible solutions, how can we use it?

Answer: Descartes' rule says that the maximum real solutions to a polynomial equation is the number of sign changes. Insurance products generally have a single sign change in the cash flows, between the initial investment and the first cash inflow, so they have only one real solution.

Question: Do other industries often have more than one sign change?

Answer: The classic example of two sign changes is a strip mining firm in the mid-West. The firm invests \$50 million the first year searching for coal and preparing its mining operations. It earns \$10 million a year for 15 years mining and selling the coal. Once the coal has been extracted and the mine is closed, the firm spends \$35 million on restoring the environment to its pre-mining condition. The IRR equation for this project has two roots. This problem with IRR equations hardly ever occurs for insurance projects.

Pitfall 3, mutually exclusive projects, is the greatest difference between NPV and IRR. Most business persons (and actuaries) prefer the IRR perspective; most academics agree with Brealey and Myers. Brealey and Myers assume that unused cash earns the opportunity cost of capital; this is the definition of the opportunity cost of capital. If projects A and B have the same IRR, but Project A is larger or lasts longer than Project B:

- Project A is preferred (higher NPV) if these are positive NPV projects.
- Project B is preferred (higher NPV) if these are negative NPV projects.

Actuaries often use the IRR view, assuming that unused cash earns the same return as cash invested in the project. The pricing actuary estimates that the policy earns a Z% IRR, whether it is one policy or 100 policies. The practice problems explain this in detail.

Question: Why do we care which project is preferred? Why not accept both?

Answer: If we can accept both projects, we do that; IRR and NPV give the same result. The difference occurs only if the projects are mutually exclusive or if the firm has funding constraints and can't afford both projects.

Question: For the final exam, whose perspective do we use?

Answer: The final exam may give two projects and ask which has the higher NPV and which has the higher IRR. It doesn't ask which perspective is correct.

Pitfall 4 is not discussed in the rest of the textbook. The term structure of interest rates is important for investment theory, but it is of less concern in the practical application of IRR. The term structure is relatively flat after the first two years, and a single rate can be used.