Module 1

Corporate Financial Decision-Making for Value Creation

Internal Rate of Return Analysis (Play the percentages ...)

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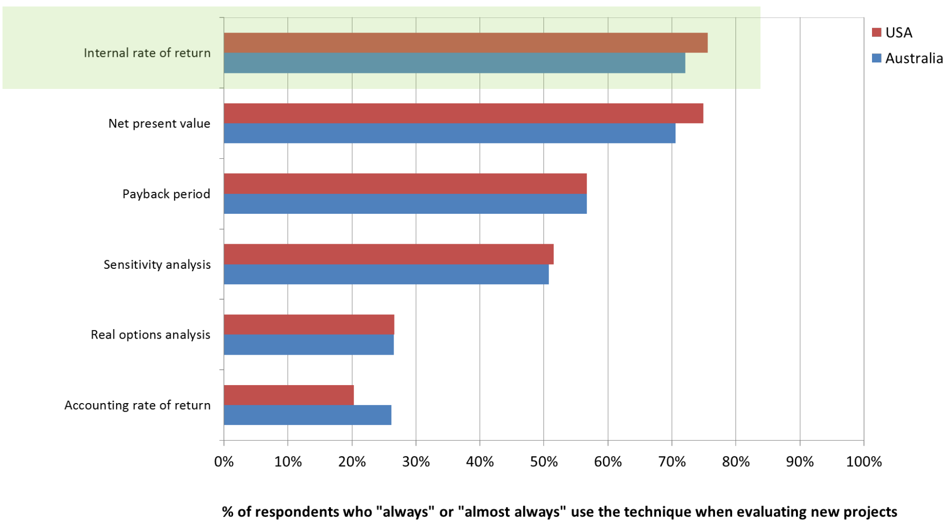
Popularity of project evaluation techniques



The technique

A project's Internal Rate of Return (IRR) is simply the discount rate that when applied to a project's expected cash flows yields NPV = 0.

Recall standard NPV:

$$NPV = -I_0 + \frac{Cash\ Flow_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} \ldots + \frac{CF_n}{(1+r)^n}$$

Adapt for Internal Rate of Return:

With NPV = 0:

$$0 = -I_0 + \frac{Cash\ Flow_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \frac{CF_3}{(1+IRR)^3} \ldots + \frac{CF_n}{(1+IRR)^n}$$

The technique

There are four simple steps to the IRR approach:

1. Forecast expected cash flows
- Timing and amount.

2. Select a discount rate and use this to discount expected cash flows to present values; subtract investment cost and calculate NPV.

3. Compare NPV with "0"
- If NPV>0 increase discount rate
- If NPV<0 decrease discount rate, until NPV = 0.

4. Apply the appropriate decision rule
- Are you assessing an *independent* project?
- Are you ranking *mutually exclusive* projects?

Demonstration

Using our earlier example

−$2 m	+$0.8m	+$0.8m	+$0.8m	+$0.8m
0	1	2	3	4

$$NPV = -2m + \frac{800,000}{(1+r)^1} + \frac{800,000}{(1+r)^2} + \frac{800,000}{(1+r)^3} + \frac{800,000}{(1+r)^4}$$

Try *r* = 10% p.a.

$$NPV = -2m + \frac{800,000}{(1.10)^1} + \frac{800,000}{(1.10)^2} + \frac{800,000}{(1.10)^3} + \frac{800,000}{(1.10)^4} = \$535,892$$

Try *r* = 25% p.a.

$$NPV = -2m + \frac{800,000}{(1.25)^1} + \frac{800,000}{(1.25)^2} + \frac{800,000}{(1.25)^3} + \frac{800,000}{(1.25)^4} = -\$110,720$$

Demonstration

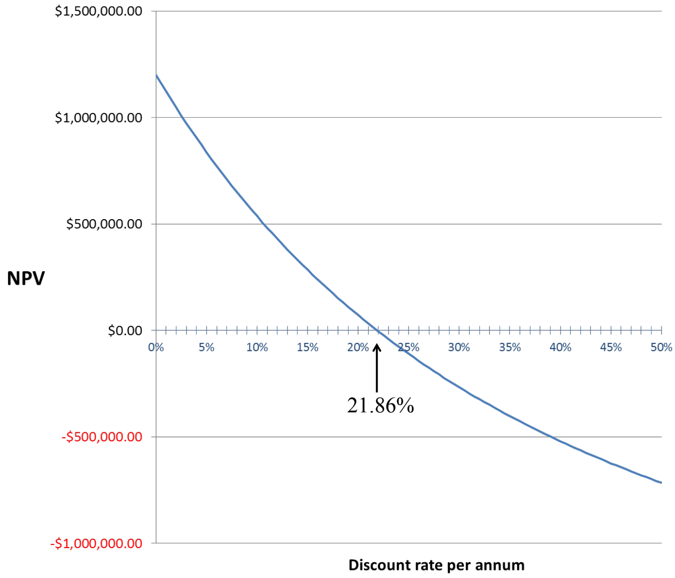
Using our earlier example

−$2 m	+$0.8m	+$0.8m	+$0.8m	+$0.8m
0	1	2	3	4

Try *r* = 21.86% p.a.

$$NPV = -2m + \frac{800,000}{(1.2186)^1} + \frac{800,000}{(1.2186)^2} + \frac{800,000}{(1.2186)^3} + \frac{800,000}{(1.2186)^4} \approx 0$$

Demonstration



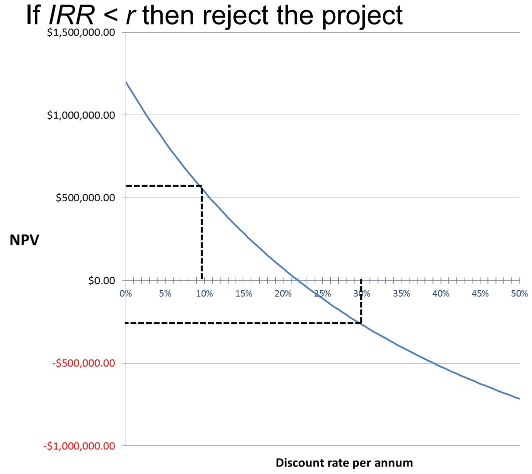
Demonstration

Apply the decision rule:

1. <u>Independent projects</u>

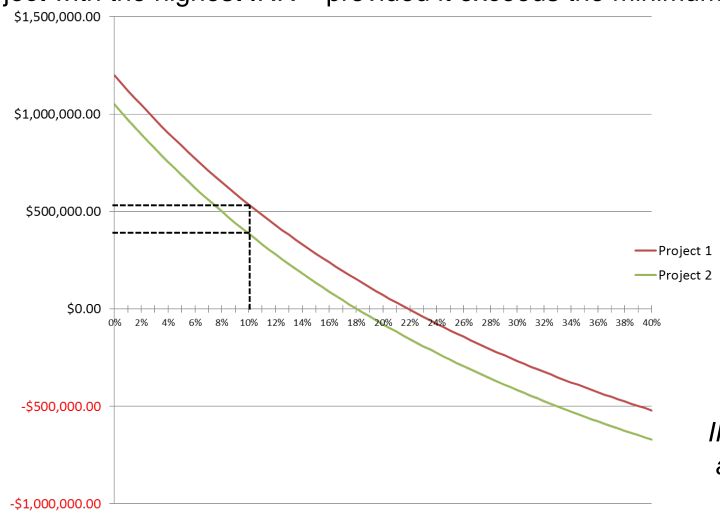
   If $IRR > r$ then accept the project

   If $IRR < r$ then reject the project



Demonstration

2. Mutually exclusive projects
   Choose the project with the highest IRR – provided it exceeds the minimum benchmark (*r*)



So … it looks like IRR gives the same answer as NPV … or does it …?

Possible problems with IRR

1. Some project's don't have them!
   Consider the following two projects:

Project 3

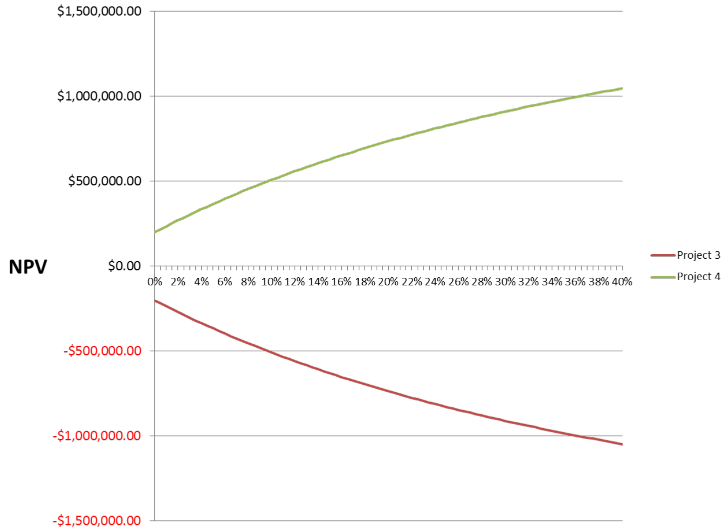
−$2 m	+$0.6m	+$0.6m	+$0.6m
0	1	2	3

Project 4 (involves borrowing)

+$2 m	-$0.6m	-$0.6m	-$0.6m
0	1	2	3

Possible problems with IRR

1. Some projects don't have an IRR



Possible problems with IRR

2. Some project's have multiple IRR!
   Consider the following project:

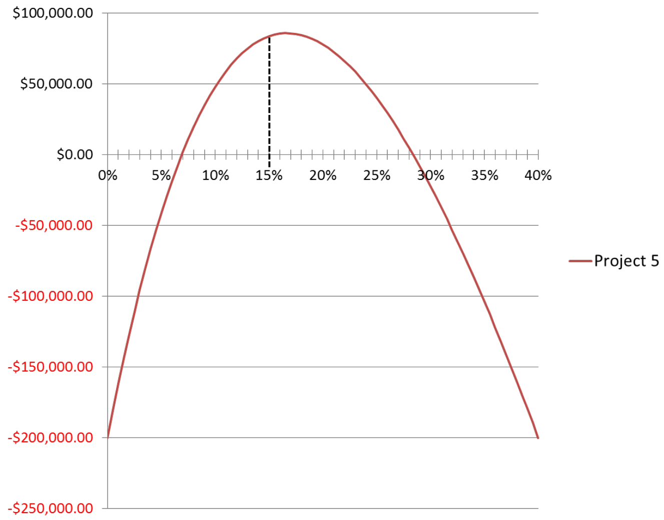
Project 5

−$10.2m	+$24m	−$14m
0	1	2

$$NPV = -10.2m + \frac{24m}{(1+r)^1} - \frac{14m}{(1+r)^2}$$

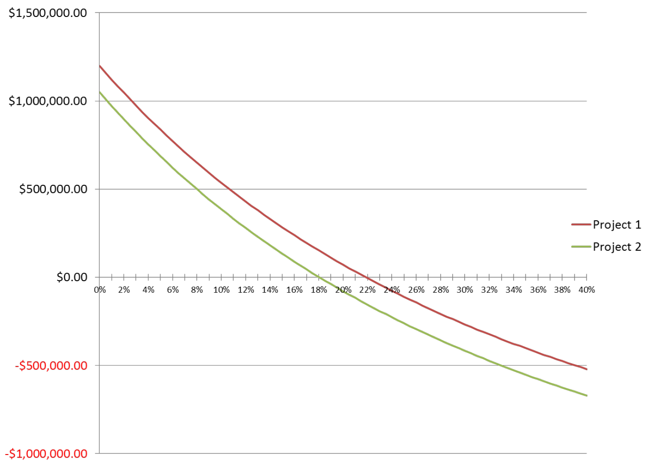
Possible problems with IRR

2. Some projects have multiple IRR!



Possible problems with IRR

3. Conflicting rankings for mutually exclusive projects
   Recall the decision rule for mutually exclusive projects:



Possible problems with IRR

3. Conflicting rankings for mutually exclusive projects

   Now consider the following two projects:

Project 6

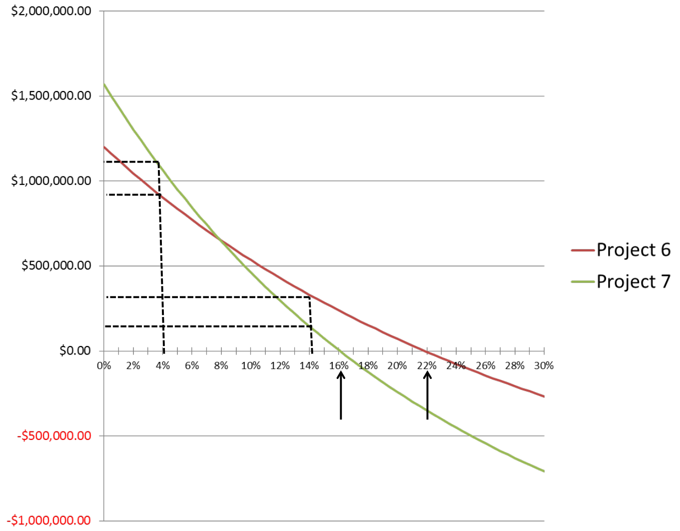
0	1	2	3	4
–$2 m	+$0.8m	+$0.8m	+$0.8m	+$0.8m

Project 7

0	1	2	3	4
–$2 m	+$0.02m	+$0.05m	+$0.2m	+$3.3m

Possible problems with IRR

3. Conflicting rankings for mutually exclusive projects



Summary

The IRR technique is a popular DCF-based approach to project evaluation.

It represents the discount rate that when applied to a project's cash flows yields NPV = 0.

There are four simple steps:

1. Forecast cash flows
2. Select a discount rate and discount cash flows
3. Compare NPV to "0"; adjust accordingly
4. Apply the decision rule.

Caution needs to be exercised when using IRR technique because of:

- Missing IRR
- Multiple IRR
- IRR conflicting with NPV decision.

Source list

Slide 2:
% respondents who "always" or "almost always" use the technique when evaluating new projects graph. Prepared by Sean Pinder from data sourced from Graham, J. R., & Harvey, C. R. (2001). The theory and practice of corporate finance: Evidence from the field. Journal of Financial Economics, 60(2), pp. 187-243; Coleman, L., Maheswaran, K., & Pinder, S. (2010). Narratives in managers' corporate finance decisions. Accounting & Finance, 50(3), pp. 605-633. © The University of Melbourne.

Slide 7 and 8: Discount rate vs NPV graph. Prepared by Sean Pinder. © The University of Melbourne

Slide 9 and 14: Mutually exclusive projects graph. Prepared by Sean Pinder. © The University of Melbourne

Slide 11: Some projects don't have an IRR graph. Prepared by Sean Pinder. © The University of Melbourne

Slide 13: Some projects have multiple IRR! Graph. Prepared by Sean Pinder. © The University of Melbourne

Slide 16: Conflicting rankings for mutually exclusive projects. Prepared by Sean Pinder. © The University of Melbourne