NAP-GSP
NATIONAL ADAPTATION PLAN GLOBAL SUPPORT PROGRAMME

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Resilient nations.

Prioritization of Climate Change Adaptation Options

The Role of Cost-Benefit Analysis

Session 7: Conducting CBA Step 6

Accra (or nearby), Ghana
October 25 to 28, 2016

8 steps

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Step 1: Define the scope of analysis.

Step 2: Identify all potential physical impacts of the project.

Step 3: Quantify the predicted impacts: With and without project

Step 4: Monetize impacts.

Step 5: Discount to find present value of costs and benefits.

Step 6: Calculate net present value.

Step 7: Perform expected value and/or sensitivity analysis.

Step 8: Make recommendations.

Step 6: Calculate net present value

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Net Present Value:

Net Present Value = PV of Benefits – PV of Costs

$$= \sum_{t=0}^{\infty} \frac{B_t}{(1+r)^t} - \sum_{t=0}^{\infty} \frac{C_t}{(1+r)^t}$$

$$= \sum_{t=0}^{\infty} \frac{(B_t - C_t)}{(1+r)^t}$$

Decision rule:

Project is good if NPV is positive; or
Choose project (or option) with the largest NPV.

Step 6: Calculate net present value

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Different calculation: Internal rate of return

IRR is the value of the discount rate such that:

$$\sum_{t=0}^{\infty} \frac{(B_t - C_t)}{(1+\lambda)^t} = 0$$

Decision rule:

If λ > r then this is a good project;
If λ < r then this is a bad project;
Choose the project with the largest λ

Step 6: Calculate net present value

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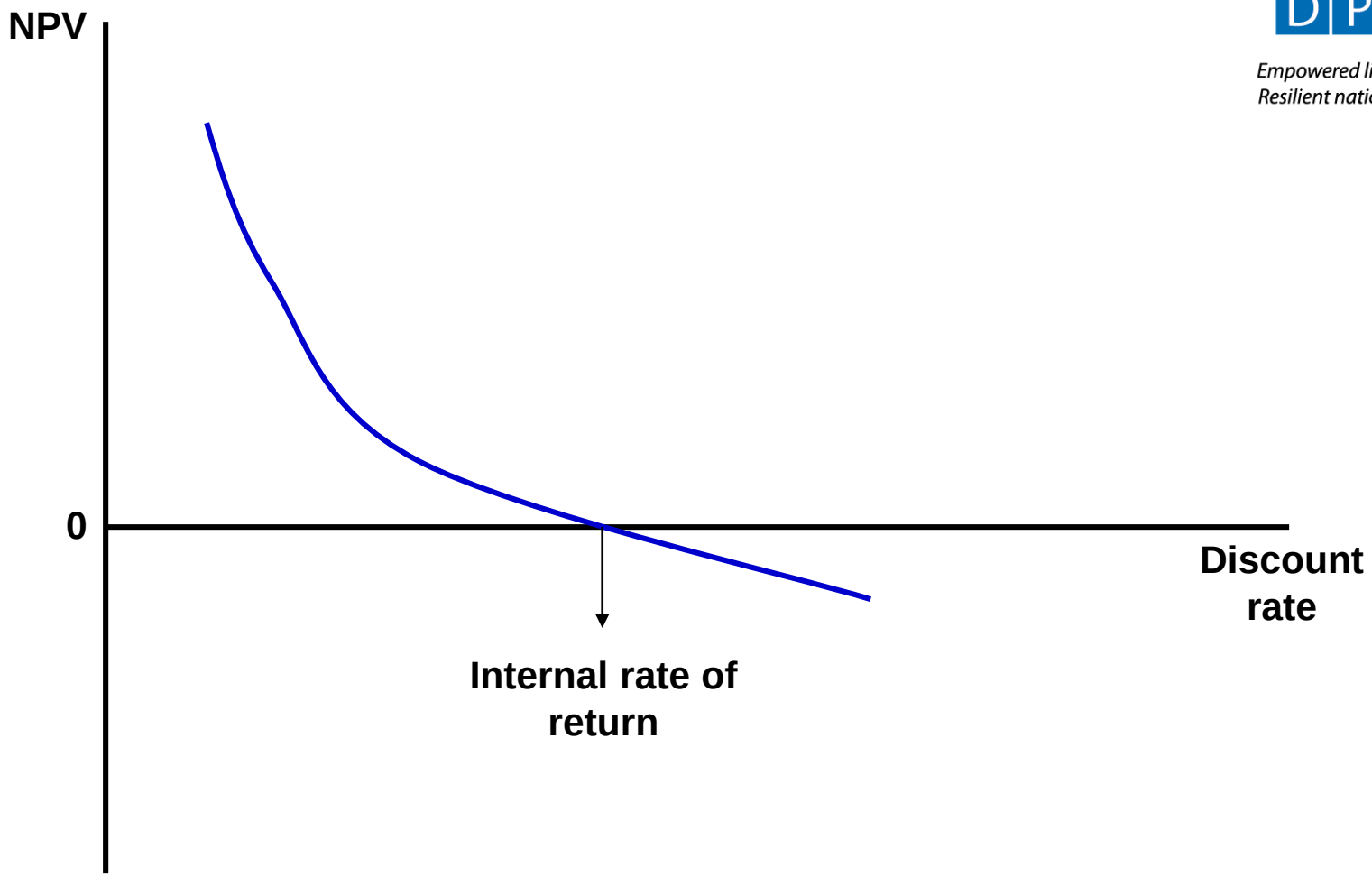

Step 6: Calculate net present value

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Different calculation: Benefit-cost ratio:

B/C ratio is simply

$$\frac{\sum_{t=0}^{\infty} \frac{B_t}{(1+r)^t}}{\sum_{t=0}^{\infty} \frac{C_t}{(1+r)^t}}$$

Decision rule:

If B/C ratio is greater than 1, then this is a good project;
If B/C ratio is less than 1, then this is a bad project.

Step 6: Calculate net present value

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Net Present Value:

Net Present Value = PV of Benefits – PV of Costs

Decision rule:

Project is good if NPV is positive; or
Choose project (or option) with the largest NPV.

Cost Benefit Ratio:

Cost Benefit Ratio = PV of Benefits / PV of Costs

Decision rule:

Project is good if B/C is greater than 1;
Choose project (or option) with the largest B/C ratio.

Internal Rate of Return:

Internal Rate of Return is the discount rate such that NPV equals zero.

Decision rule:

Project is good if IRR is larger than some target rate of return;
Choose project (or option) with the largest IRR.

Step 6: Calculate net present value

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If there is only one project, or one activity to consider, then NPV, IRR, and B/C ratio will provide us with the same answer as to whether or not the project is 'good' or 'not good' for society.

Step 6: Calculate net present value

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If only one project:

Decision to make: Is this a good project or not?

All 3 criteria should give the same answer:

If
PV benefits > PV costs
i.e.
NPV > 0

→ **Then it must be that**
B / C > 1

All 3 criteria yield the same answer.

→ **And it must be that**
IRR > Discount rate

Step 6: Calculate net present value

If only one project:

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However, there could be problems with IRR. There could be more than one IRR.

Descartes' rule of signs: The number of IRR depends on the number of times the net benefits change signs.

Net benefits	-	-	-	+	+	+	+	+

NB change signs once: 1 IRR

Net benefits	-	-	-	+	+	+	+	-

NB change signs twice: 2 IRR

Step 6: Calculate net present value

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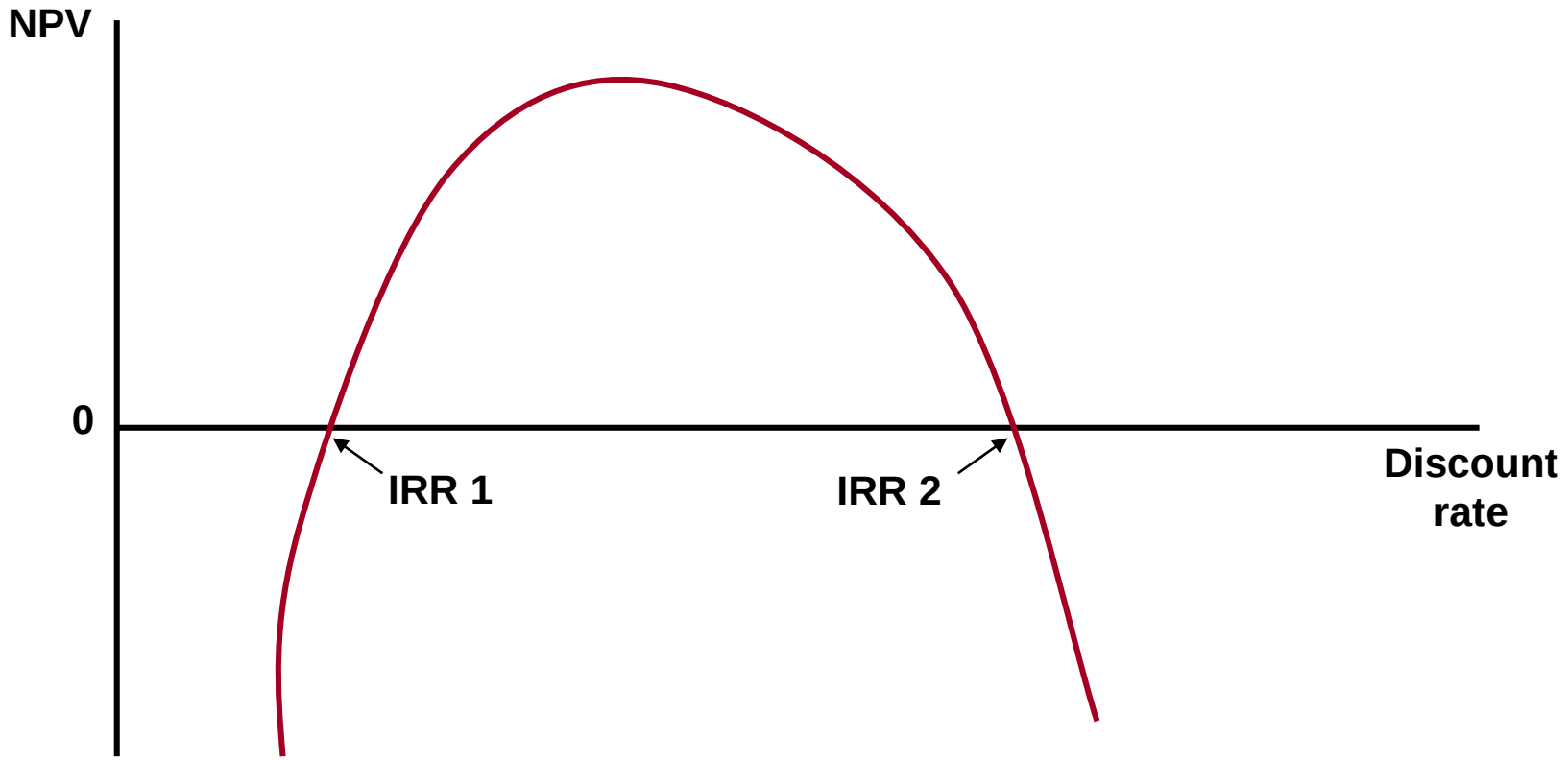
You may then have two IRRs.



Better to use NPV

Step 6: Calculate net present value

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If more than one project (mutually exclusive projects):

If there is more than one project, or more than one activity, or more than one option and if we aim to rank these projects or activities or options to choose the best one(s), then it is better to use NPV.

IRR and B/C ratio could lead us to choose the wrong project.

Step 6: Calculate net present value

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If more than one project (mutually exclusive projects):

Decision to make: Which project to accept?

Consider the following situation:

	Project A	Project B
PV of costs	100	20
PV of benefits	200	60

NPV vs. B/C ratio.

Better to use NPV

Step 6: Calculate net present value

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If more than one project (mutually exclusive projects):

Consider the following situation:

Year	Net Benefits Project A	Net Benefits Project B
0	- 1000	-500
1	475	256
2	475	256
3	475	256

NPV with r = 5%	$ 187.76	$ 279.56
IRR	25%	20%

Step 6: Calculate net present value

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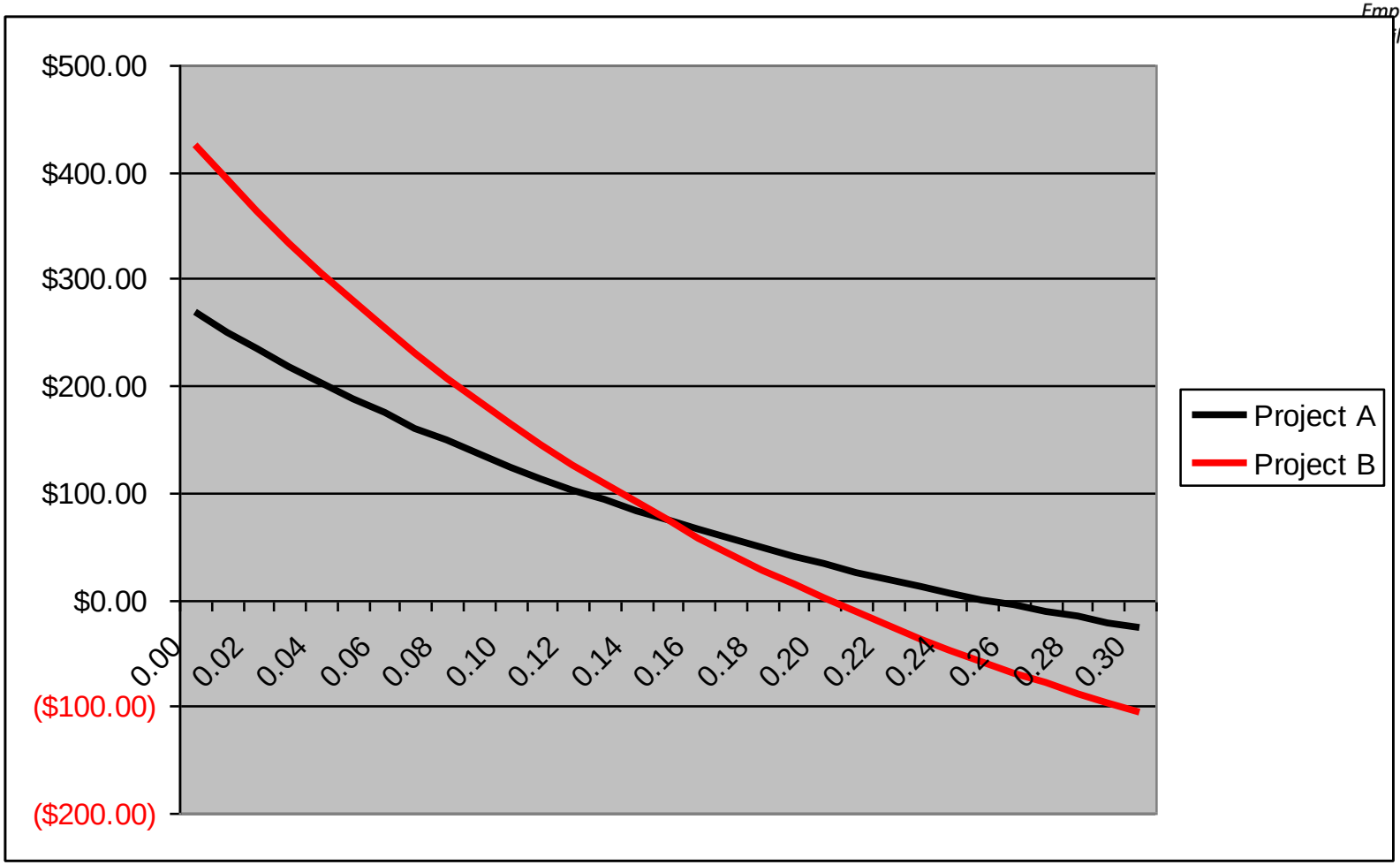

Step 6: Calculate net present value

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Better to use NPV

Step 6: Calculate net present value

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Always better to use NPV.

NPV will always guide you to the correct decision.

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