

Teach Yourself: Economic Evaluation:

3c. Decision Making

NPV - Good and Bad

Spend only a few seconds on most slides.

Economic evaluation has three levels ...

Level 3: Decision making

Level 2: Evaluating the business/project

Level 1: Hands-on economic modelling

The purpose of this module is to...

Level 3: Decision making

Level 2: Evaluating the business project

Level 1: Hands-on economic modelling

**recognise the
power of NPV but
understand its
limitations**

Making the final decision

The final decision should be based on

1. a **basket** of economic measures
2. → using **judgement!**

It is much more than NPV because...

NPV

NPV is a wonderful concept that forces people to evaluate the project/business in a logical and comprehensive manner.

- ▶ The activity of gathering and understanding all the drivers is very powerful.
 - It is the perfect opportunity for you to get out and build a working relationship with the key experts in the project/business
- ▶ Everyone learning the subtleties of how each driver interacts with other drivers and how they influence NPV is most important
- ▶ A single final NPV can cleverly assess a comprehensive array of scenarios, options and risks by combining them all into one weighted value.
 - The final NPV can be of
 1. a single case or
 2. a set of probability weighted cases with their options, or
 3. a sophisticated probabilistic computation.

NPV methodology ...

NPV can account for multiple scenarios. It can assess a range of possible outcomes, each with optionality. It can use simple or complex mathematics.

| | Computation Method | Final NPV |
|---------------|--|-----------|
| Alternative K | One case | 50 |
| Alternative K | Multiple cases with optionality - probability weighted | 53 |
| Alternative K | Sophisticated probabilistic mathematics | 48 |

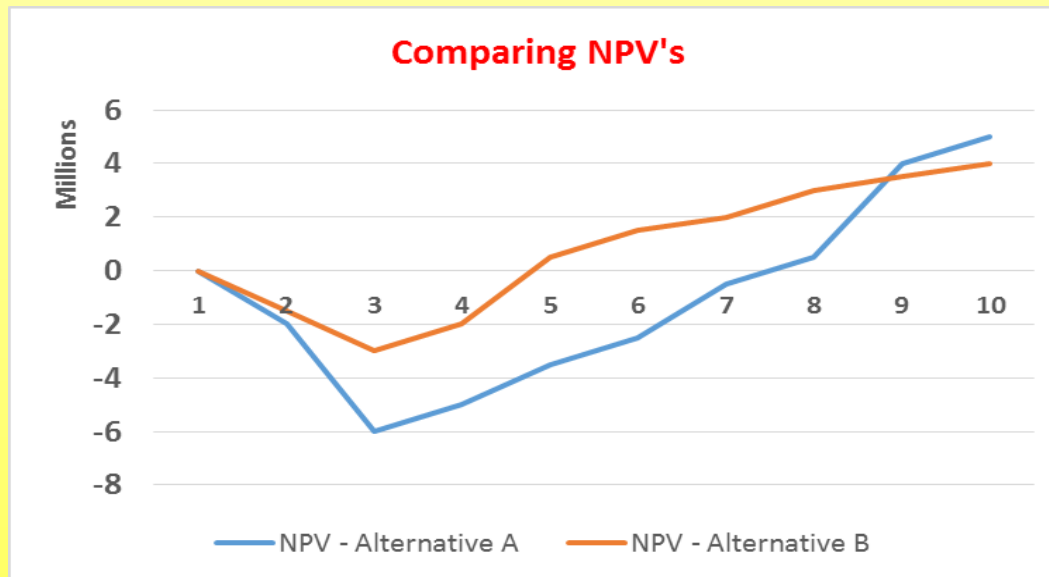
Unfortunately, some mathematically oriented people put their whole trust in NPV.

But the best decision is a lot, lot more than selecting the highest NPV alternative: even when this NPV is 'expected' or probability weighted.

The limitations of NPV ...

If this was your business, would you select Alternative A below because it has the highest NPV?

Or would you select Alternative B with lower investment, faster pay-back, earlier positive NPV, lower risk but a smaller final NPV?



There is a famous major project where the final NPV was the main metric and it was repeatedly reported to top management as positive. (Did they realize that it required huge ongoing injections of cash over 30+ years and NPV would be terribly negative for decades until it suddenly turned positive in the final years? They were told “It has an attractive NPV!”)

The limitations of NPV ...

A major deficiency of NPV is that it does not indicate the size of the upfront investment.

| | Initial investment | Final NPV |
|---------------|--------------------|-----------|
| Alternative J | 100 | 75 |
| Alternative H | 55 | 75 |

- ▶ According to NPV both alternatives are equal.
- ▶ This is where IRR is a very useful co-measure.
- ▶ NPV = 'quantity' while IRR = 'quality'

The limitations of NPV ...

Another major deficiency of NPV is that it does not indicate how long to get positive NPV

| | Pay Back | Final NPV |
|---------------|----------|-----------|
| Alternative p | 3 years | 75 |
| Alternative Q | 33 years | 90 |

- ▶ According to NPV Alternative Q is better.

Too many times a project leader has told the management that “Alternative Q definitely has the better NPV.” This may not be outright dishonesty but it is very misleading.

- ▶ This is where Payback is a very useful co-measure.

Payback can be computed in various ways

The limitations of NPV ...

NPV does not tell you how your project or business is positioned in that industry, your cost competitiveness, your ability to flex operations to capture booms and ride-out market troughs.

| | Industry, Competitiveness, Flexibility, | Final NPV |
|---------------|---|-----------|
| Alternative S | poor | 50 |
| Alternative T | good | 50 |

- ▶ According to NPV they are equal

NPV limitations ...

NPV does not necessarily get more accurate with more sophisticated mathematics.

(but NPV does gets more accurate with better forecasts of price, sales, opex and capex)

| | Computation Method | Final NPV |
|---------------|--|-----------|
| Alternative S | One case (perhaps with optionality) | 48 |
| Alternative S | Multiple cases with optionality - probability weighted | 42 |
| Alternative S | Sophisticated probabilistic | 53 |

Above, Alternative S is assessed by three methods -

1. The decision makers may find the 'one case' is best to rapidly understand the business and to expose its drivers. To get a good feel for what it is all about!
2. They might see the 'multiple cases' providing a useful range of outcomes. How good it might become and how bad it might turn.
3. They might feel that the 'sophisticated probabilistic NPV' is 'interesting' but for this situation it is too much of an act of faith in software and mathematics where garbage in gives garbage out.

NPV limitations ...

Decision makers should be very wary when a project's NPV is unsatisfactory (either as one case or as multiple cases with optionality), but then is said to be attractive when probabilistic/Black Scholes is used "to recognise its full value".

| | Computation Method | Final NPV |
|---------------|--|-----------|
| Alternative S | One case (perhaps with optionality) | -4 |
| Alternative S | Multiple cases with optionality - probability weighted | -1 |
| Alternative S | Sophisticated probabilistic Black Scholes | +35 |

Alarm bells!!!

You must understand why.

Be sure to decide with your eyes wide open!

The biggest limitation of NPV ...

Perhaps the biggest limitation of NPV is that it totally relies upon the forecasts of 'experts'. *It is the mathematical treatment of a set of opinions.*

Usually the forecasts are by competent specialists and hopefully are as good as you can get. But the forecasts by these experts will evolve over time as the world changes. How the economy of the world and markets have roller-coasted since 2000!

In all but cost reduction evaluations, the key cashstream is likely to be revenue, so forecasts of price, exchange rate, production/sales and quality are crucial. A price forecast made today is likely to be in a very different market to one in ten years time.

Think of a project or business being valued today versus last decade (or in another ten years time). The mathematics will be the same but the opinions of the experts will be very different.

NPV ...

NPV should be one of the primary measures of a project or business, but a decision deserves a lot, lot more evaluation work.

Further reading ...

When the NPV is too low ...

When the NPV is too low for the project to proceed do NOT:

1. Pressure the experts who provided forecasts of price and sales to revise upwards.
2. Badger the experts who estimated capex estimates to trim the indirects, such as contingency and owner's costs, force them to use second hand plant and speed up study/construction.
3. Cajole the experts in operations to squeeze up recoveries, lower costs, speed up ramp-up, increase production.
4. Use debt financing (this shows you do not properly understand discounting theory)
5. Resort to probabilistic valuation or to Black Scholes.

All these are indicators of a project that is deficient as it is proposed.

Instead use your constructive and positive lateral thinking to help reshape the business and to create a better solution for the opportunity.

Probabilistic limitations ...

Some companies lose their way by resorting to sophisticated economic evaluation modelling such as: -

- ▶ Monte Carlo
- ▶ Crystal Ball
- ▶ Other probabilistic software

These seem very credible when described by their promoters, especially when their use in oil and gas is well established and credible. Unfortunately they can have major deficiencies when applied to mining and minerals.

Several of the key drivers can be interlinked by algorithms but usually these are too rigid and unrealistic. Even worse is that some of the dominant drivers cannot be properly linked. One classic failing is that when price forecasts are increased and decreased the mine schedule and production plan does not get recomputed for each iteration. (New mine schedules/production plans are major undertakings that usually take days to recompute.)

If decision makers cannot immediately understand an evaluation then they should not get bedazzled by mathematical mastery.

Similarly if a project needs probabilistic modelling or Black Scholes to get over the threshold then the decision makers are deceiving themselves.

End