Scenario Analysis vs. Sensitivity Analysis
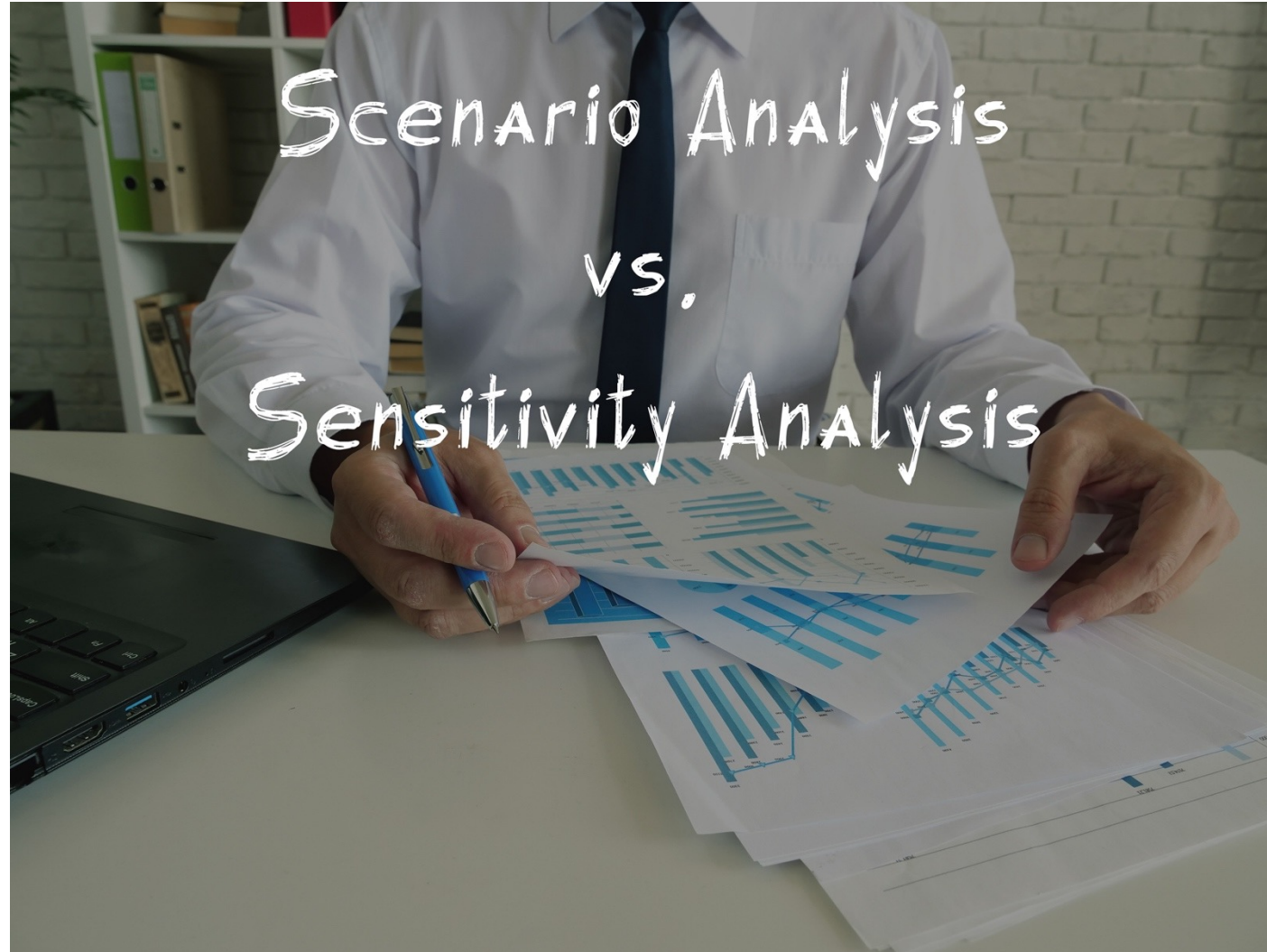
Dealing with Uncertainty...

Up until now, we've assumed that the values for our economic analyses have been accurate.

But how do you forecast the future with certainty?

What if your estimates are off by some amount?

How much variability would be necessary before the decision is affected?

In this series of lessons, we'll explore several different ways of handling uncertainty – otherwise known as risk!

Dealing with Uncertainty...

Ex. Your company invests in a new 3D Printing Machine for $100,000. The anticipated after-tax profits resulting from the printer are $40,000 per year for 5 years. The discount rate = 16%.

What is the NPV and IRR of this project?

	A	B	C	D	E	F	G
1	3D Printer Project - Base Case						
2							
3	Initial Investment:	$100,000					
4	Annual After-Tax Cash Flows:	$40,000					
5	Useful Life (years):	5					
6	Discount Rate:	16%					
7							
8				End of Year Cash Flows			
9	Year	0	1	2	3	4	5
10	Annual Cash Flow	-$100,000	$40,000	$40,000	$40,000	$40,000	$40,000
11							
12	PV (Yr 1-5):	$130,972	=NPV(B6, C10:G10)				
13	Initial Investment:	$100,000	=B3				
14	Net Present Value, NPV:	$30,972	=B12-B13				
15							
16	Internal Rate of Return, IRR:	29%	=IRR(B10:G10)				

The NPV >> 0
And the IRR >> 16%
This is a great project for investment!

Dealing with Uncertainty…

Ex. Your company invests in a new 3D Printing Machine for $100,000. The anticipated after-tax profits resulting from the printer are $40,000 per year for 5 years. The discount rate = 16%.

What is the NPV and IRR of this project?

	A	B	C	D	E	F	G
1	3D Printer Project - Base Case						
2							
3	Initial Investment:	$100,000					
4	Annual After-Tax Cash Flows:	$40,000					
5	Useful Life (years):	5					
6	Discount Rate:	16%					
7							
8			End of Year Cash Flows				
9	Year	0	1	2	3	4	5
10	Annual Cash Flow	-$100,000	$40,000	$40,000	$40,000	$40,000	$40,000
11							
12	PV (Yr 1-5):	$130,972	=NPV(B6, C10:G10)				
13	Initial Investment:	$100,000	=B3				
14	Net Present Value, NPV:	$30,972					
15							
16	Internal Rate of Return, IRR:	29%					

If you're off on these estimates…

…how does that affect the NPV and IRR?

Risk Mitigation with Scenario Analysis...

An easy way of dealing with uncertainty: Scenario Analysis

**Base Case
(Most Likely)**

*Values you believe are
most likely to occur.*

**Best Case
(Optimistic)**

*Values that could occur if everything
went better than expected.*

**Worst Case
(Pessimistic)**

*Values that could occur if things
went worse than expected!*

Scenario Analysis

Evaluate the project as a function of different forecast scenarios:

Base-Case Scenario: what you really think will happen; your estimate of the most likely future cash flows.

Worst-Case Scenario: revenues are lower than expected; costs are higher than expected; some combination of the two.

Best-Case Scenario: revenues are higher than expected; costs are lower than expected; some combination of the two.

Dealing with Uncertainty

Now create the Best-Case Scenario…

	A	B	C	D	E	F	G
1	**3D Printer Project - Best Case**						
2							
3	**Initial Investment:**	**$90,000**					
4	**Annual After-Tax Cash Flows:**	**$45,000**					
5	Useful Life (years):	5					
6	Discount Rate:	16%					
7							
8			**End of Year Cash Flows**				
9	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
10	**Annual Cash Flow**	-$90,000	$45,000	$45,000	$45,000	$45,000	$45,000
11							
12	PV (Yr 1-5):	$147,343	=NPV(B6, C				
13	Initial Investment:	$90,000	=B3				
14	**Net Present Value, NPV:**	**$57,343**	=B12-B13				
15							
16	**Internal Rate of Return, IRR:**	**41%**	=IRR(B10:G10)				

Initial investment reduced $10,000
Benefits increased $5,000

✓ Not surprisingly, the NPV and IRR are both higher.
✓ The project is an even better investment!

Dealing with Uncertainty

Now create the Worst-Case Scenario…

	A	B	C	D	E	F	G
1	3D Printer Project - Worst Case						
2							
3	Initial Investment:	$110,000					
4	Annual After-Tax Cash Flows:	$30,000					
5	Useful Life (years):	5					
6	Discount Rate:	16%					
7							
8		End of Year Cash Flows					
9	Year	0	1	2	3	4	5
10	Annual Cash Flow	-$110,000	$30,000	$30,000	$30,000	$30,000	$30,000
11							
12	PV (Yr 1-5):	$98,229	=NPV(B6, C1				
13	Initial Investment:	$110,000	=B3				
14	Net Present Value, NPV:	($11,771)	=B12-B13				
15							
16	Internal Rate of Return, IRR:	11%	=IRR(B10:G1				

Initial investment increased $10,000
Benefits increased $10,000

X Now the NPV is negative, with an IRR less than the discount rate.

X The worst-case scenario produces a project that is a poor investment for the company!

Scenario Analysis

Now what do you do with the results?

Base Case:
 NPV = $30,972
 IRR =   29%

← This looks like a promising project.

Best Case:
 NPV = $57,343
 IRR =   41%

← You're a hero if things go well.

Worst Case:
 NPV = - $11,771
 IRR =   8%

← Hmm. Career transition opportunity?

Clearly, if things don't go well this would not have been a good investment. What to do?

1. *Check your values to see if you were overly pessimistic.*
2. *Evaluate what you can do to mitigate the pessimistic scenario.*

Creating the Best and Worst-Case Scenarios…

Vary the inputs that determine the annual cash flows…

Worst Case relative to the Base Case:

  - reduce units sold by 50% (this is really a worst case!)

  - increase operating costs 20%

Calculate NPV & IRR to determine impact of things going well or perhaps not as well as you hoped.

Best Case relative to the Base Case:

  - increase units sold by 20%

  - reduce operating expenses 20%

Compare to the Base Case

How critical are # units sold and costs to your project?

- *Do a series of worst-case scenarios to determine at what point the project is no longer financially worthwhile.*

- *Then create an action plan to make sure that does not happen.*

Main Takeaways…

We make a lot of assumptions about the future cash flows in our analyses.

Scenario Analysis allows us to bracket the uncertainty around these assumptions:
    Base Case   – estimates of the most likely scenario
    Best Case   – the optimistic scenario, things go better than expected
    Worst Case – the pessimistic scenario, things go worse than expected
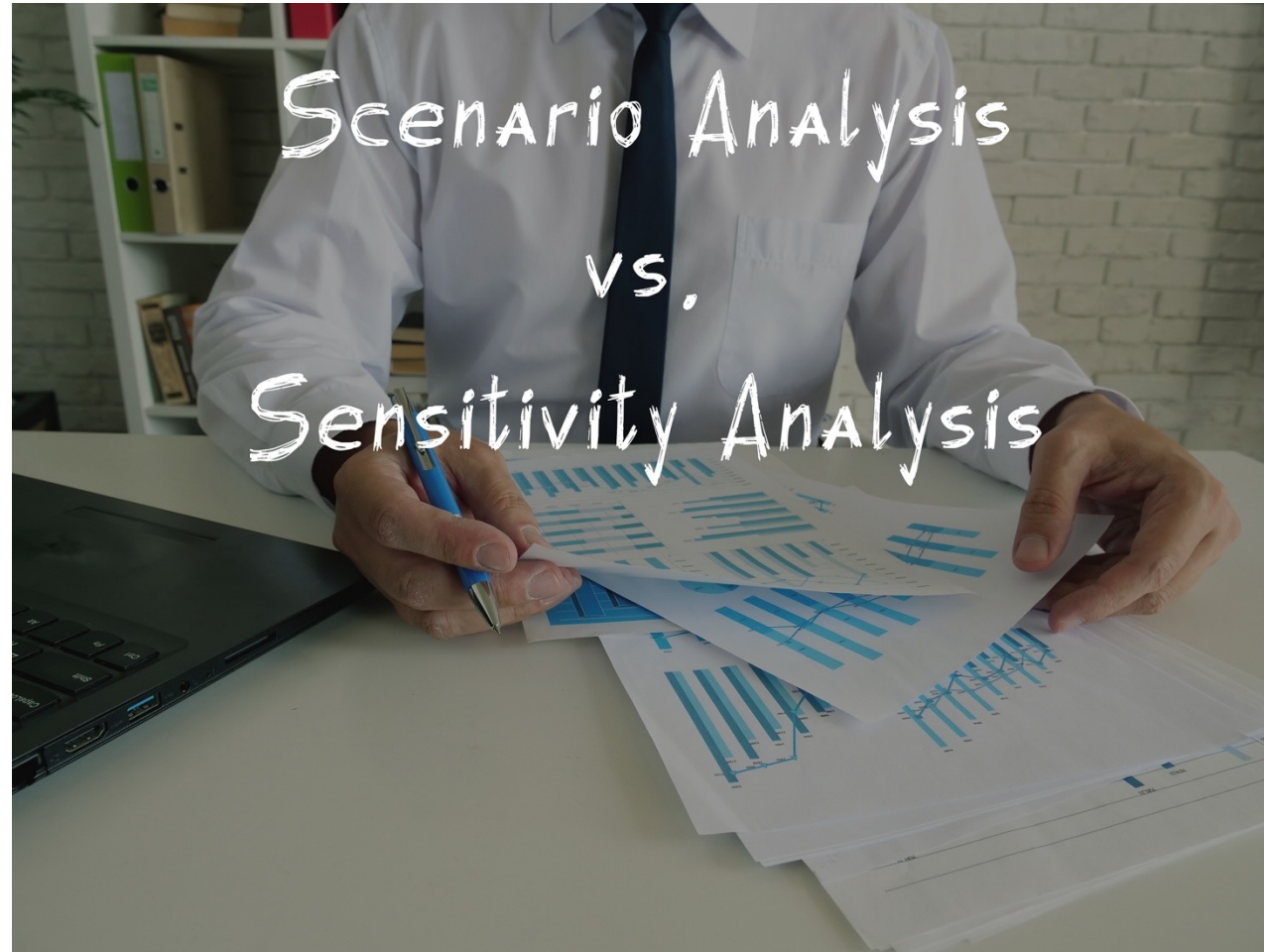
Compare the Best- and Worst-Case scenarios to the Base Case - any red flags?

Identify red flags, what is causing them, and create a plan to mitigate those risks.

Make sure you don't make your scenarios overly optimistic or overly pessimistic!

Next Time…

Sensitivity Analysis

Credits & References

Slide 1: Financial concept about Scenario Analysis vs. Sensitivity Analysis with inscription on the piece of paper by Yurii Kibalnik, Adobe Stock (399001250.jpeg).

Slide 2: Uncertainty Ahead by rnl, Adobe Stock (43385232.jpeg).

Slide 12: Financial concept about Scenario Analysis vs. Sensitivity Analysis with inscription on the piece of paper by Yurii Kibalnik, Adobe Stock (399001250.jpeg).