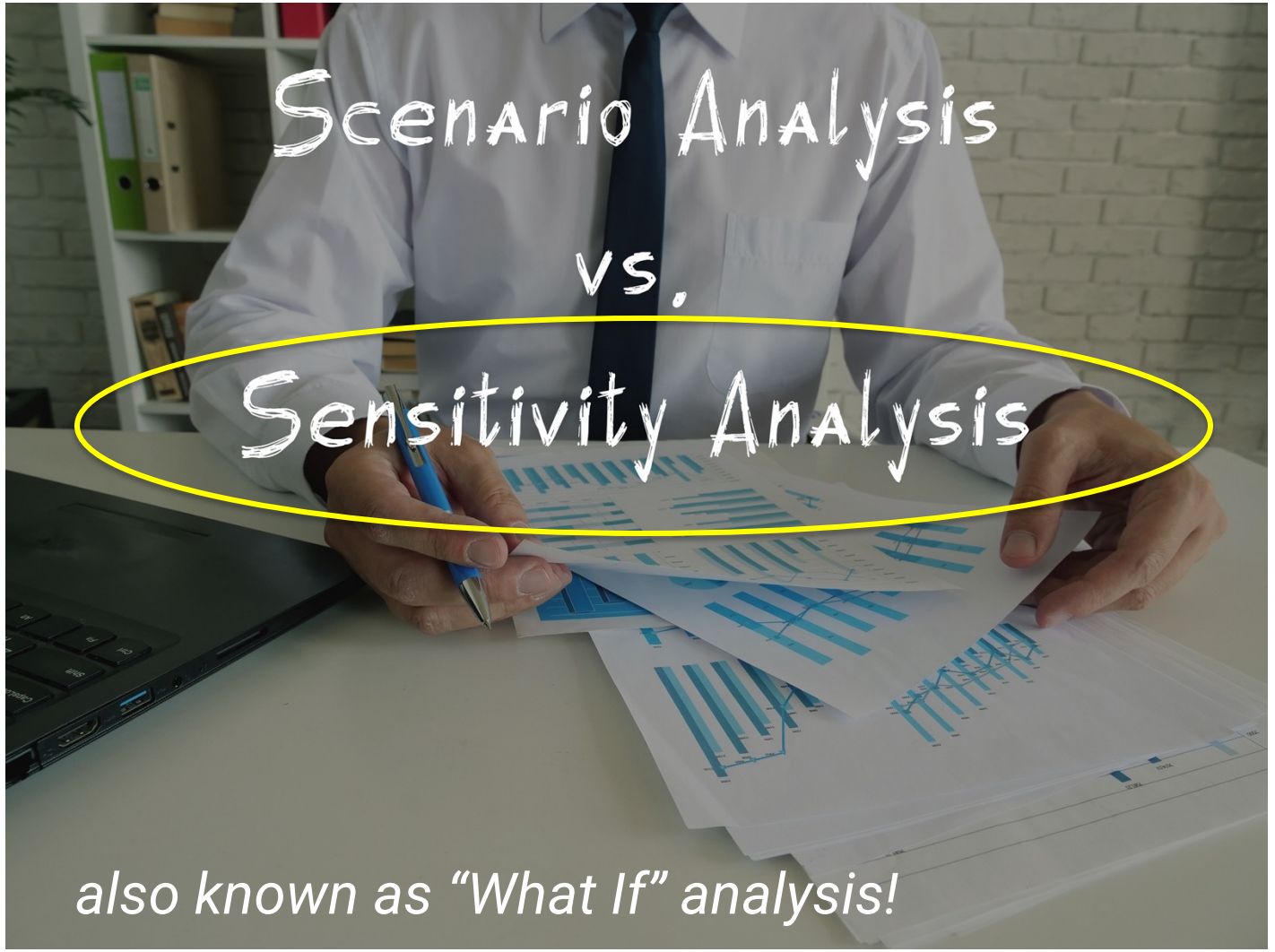
Sensitivity Analysis



Sensitivity Analysis…

Consider our definition of NPV:

$$NPV = PV_{Inflows} - PV_{Outflows}$$

$PV_{Inflows}$ = PV (Future After-Tax Cash Flows)

$PV_{Outflows}$ = Initial Investment

NPV = f (Revenues, COGS, Operating Expenses, Investment)

It isn't too surprising we have uncertainty in our NPV!

Sensitivity Analysis…

Sensitivity Analysis: determine the impact on NPV (or other parameter) by varying one variable at a time…

Ex. What happens to NPV if there is a +/- 20% uncertainty in:

- Profits
  - Revenues
    - ✓ Unit Sales
    - ✓ Sales Price
  - COGS
    - ✓ Raw Materials Expense
    - ✓ Labor Costs
- Initial Investment
- Salvage Value

Let's try an Example…

Ex. What is the impact on NPV if the future after-tax cash flows and investment vary +/- 20%.

Assume the company has a discount rate of 16% and the project has a lifetime = 5 years. The best estimate of future after-tax cash flows is $10,000 per year and the best estimate of the investment cost is $20,000.

First evaluate the "Base Case" for the NPV:

$$PV_{Inflows} = A\left[\frac{(1+i)^N - 1}{i(1+i)^N}\right]$$

$$PV_{Inflows} = \$10{,}000\left[\frac{(1+0.16)^5 - 1}{0.16\,(1+0.16)^5}\right]$$

$$PV_{Inflows} = \$32{,}743$$

$$\text{Initial Investment} = \$20{,}000$$

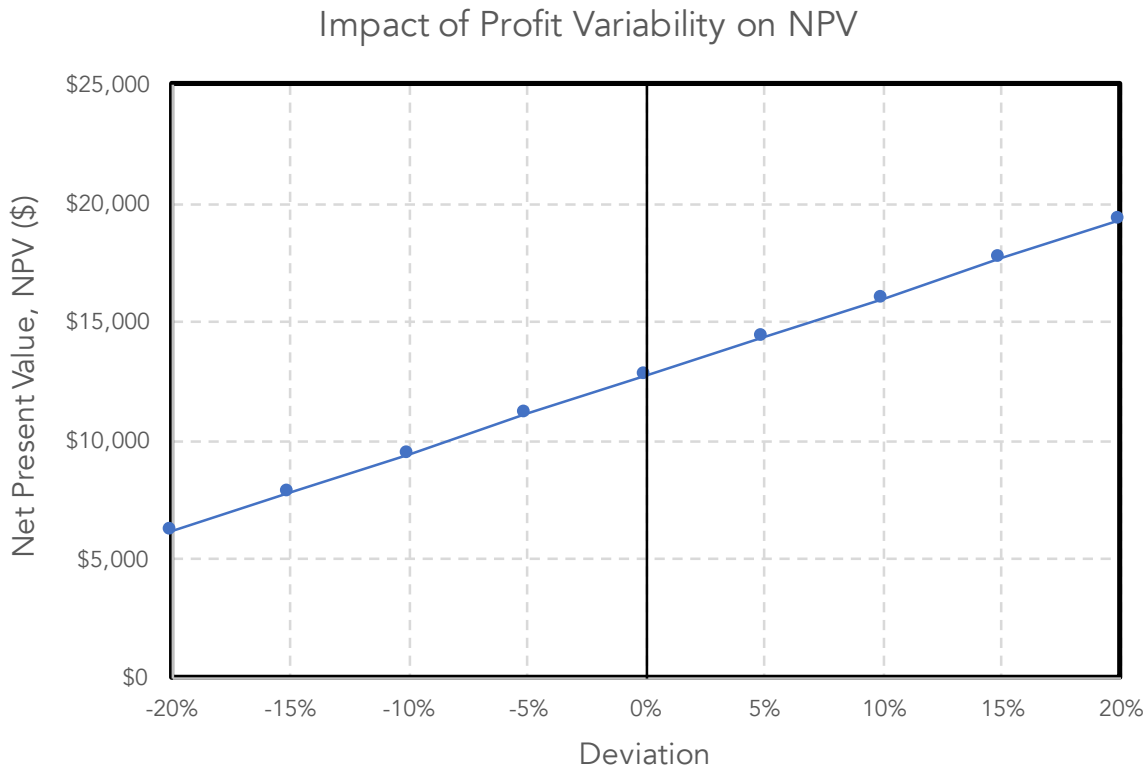
$$NPV = PV_{Inflows} - \text{Initial Investment}$$

$$NPV_{\text{Base Case}} = \$12{,}743$$

Sensitivity Analysis…

Now recalculate the NPV by varying After-Tax Profits by +/- 20%, keeping the Initial Investment constant at the Base Case...

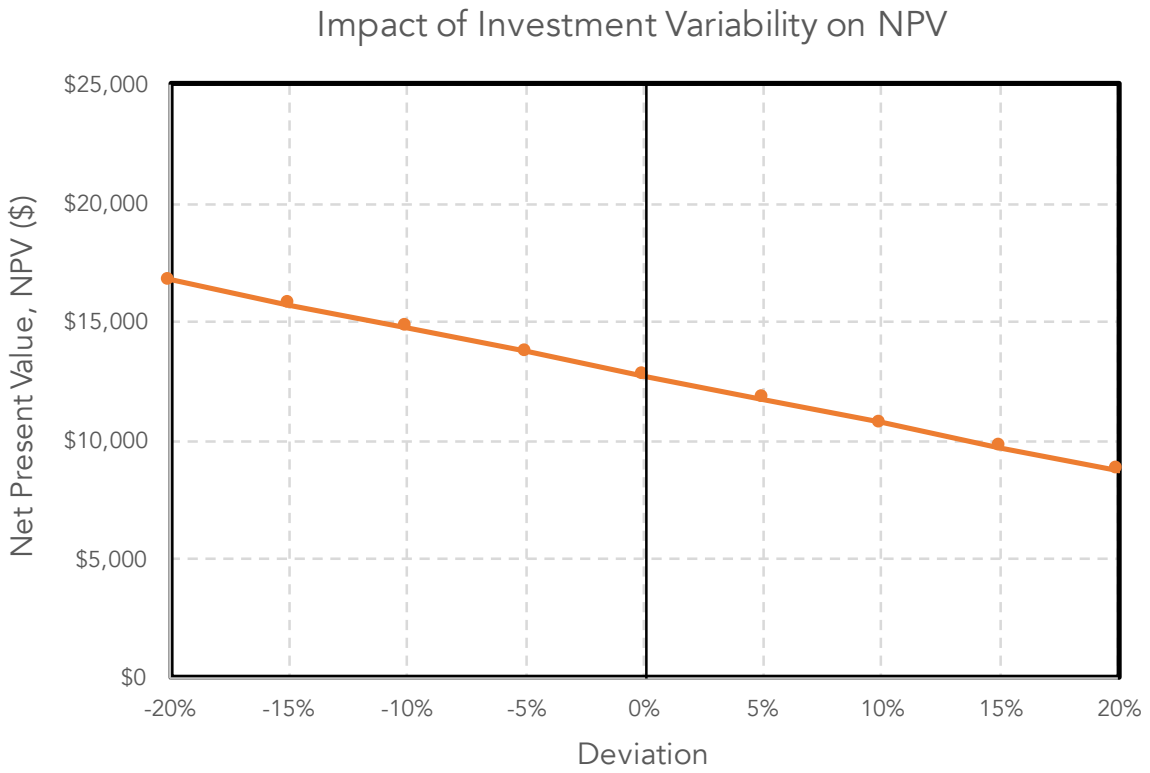
	A	B	C	D	E
1	Sensitivity Analysis Example				
2					
3	Base Case Parameters				
4		Initial Investment:	$20,000		
5		Profits:	$10,000		
6		Discount Rate:	16%		
7		Time frame (yrs):	5		
8					
9	Deviation	Profits	PV (Profits)	Init Invest.	NPV
10	-20%	$8,000	$26,194	$20,000	$6,194
11	-15%	$8,500	$27,831	$20,000	$7,831
12	-10%	$9,000	$29,469	$20,000	$9,469
13	-5%	$9,500	$31,106	$20,000	$11,106
14	0%	$10,000	$32,743	$20,000	$12,743
15	5%	$10,500	$34,380	$20,000	$14,380
16	10%	$11,000	$36,017	$20,000	$16,017
17	15%	$11,500	$37,654	$20,000	$17,654
18	20%	$12,000	$39,292	$20,000	$19,292



Sensitivity Analysis…

Now do the same thing for the Initial Investment, keeping Profits constant at the Base Case…

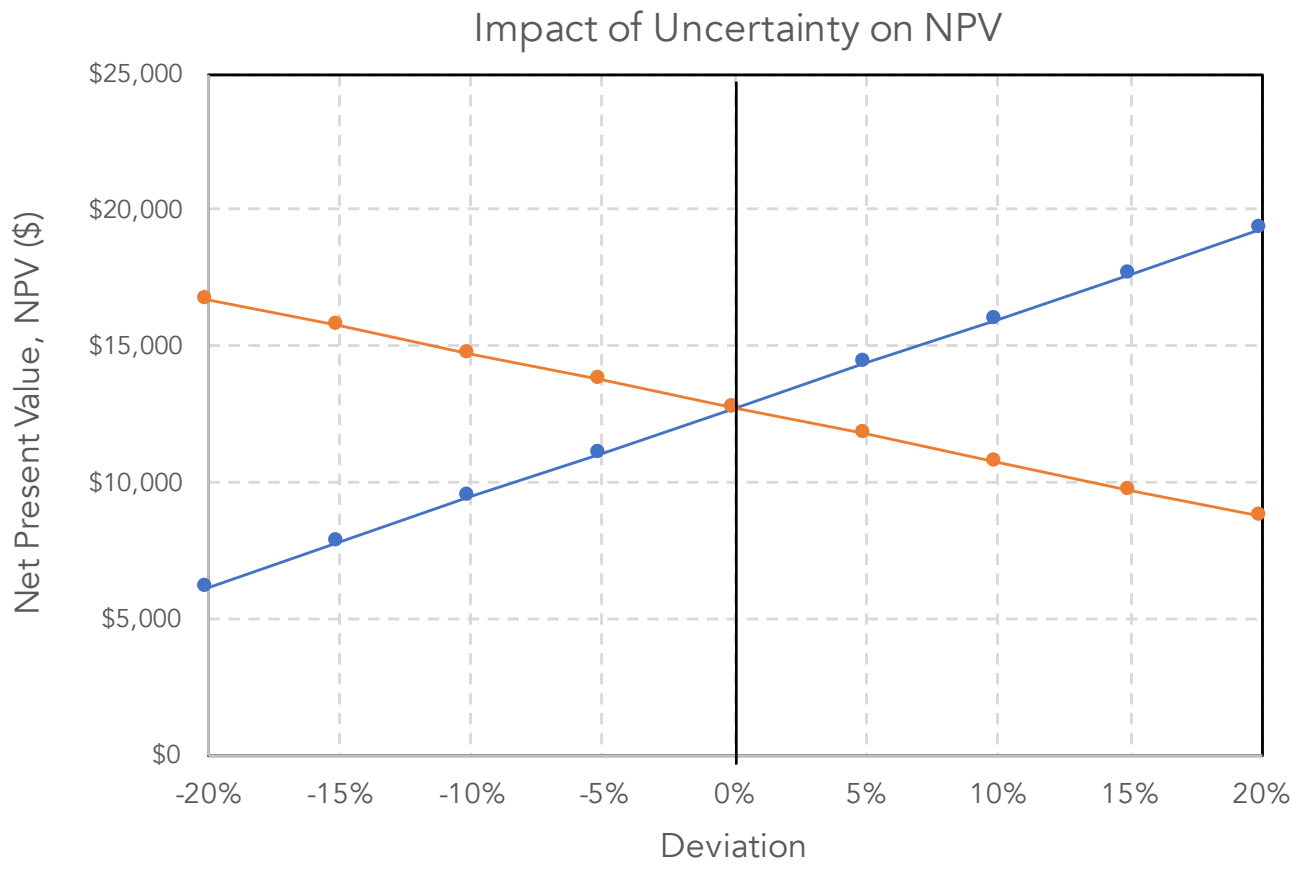
	A	B	C	D	E
21	Sensitivity Analysis Example				
22					
23	Base Case Parameters				
24		Initial Investment:	$20,000		
25		Profits:	$10,000		
26		Discount Rate:	16%		
27		Time frame (yrs):	5		
28					
29	Deviation	Profits	PV (Profits)	Init Invest.	NPV
30	-20%	$10,000	$32,743	$16,000	$16,743
31	-15%	$10,000	$32,743	$17,000	$15,743
32	-10%	$10,000	$32,743	$18,000	$14,743
33	-5%	$10,000	$32,743	$19,000	$13,743
34	0%	$10,000	$32,743	$20,000	$12,743
35	5%	$10,000	$32,743	$21,000	$11,743
36	10%	$10,000	$32,743	$22,000	$10,743
37	15%	$10,000	$32,743	$23,000	$9,743
38	20%	$10,000	$32,743	$24,000	$8,743



Sensitivity Analysis…

We could now do the same thing for any variable we think is important…

Now tie it all together…



Which variable has the greater impact?

Profits

Investment

Main Takeaways …

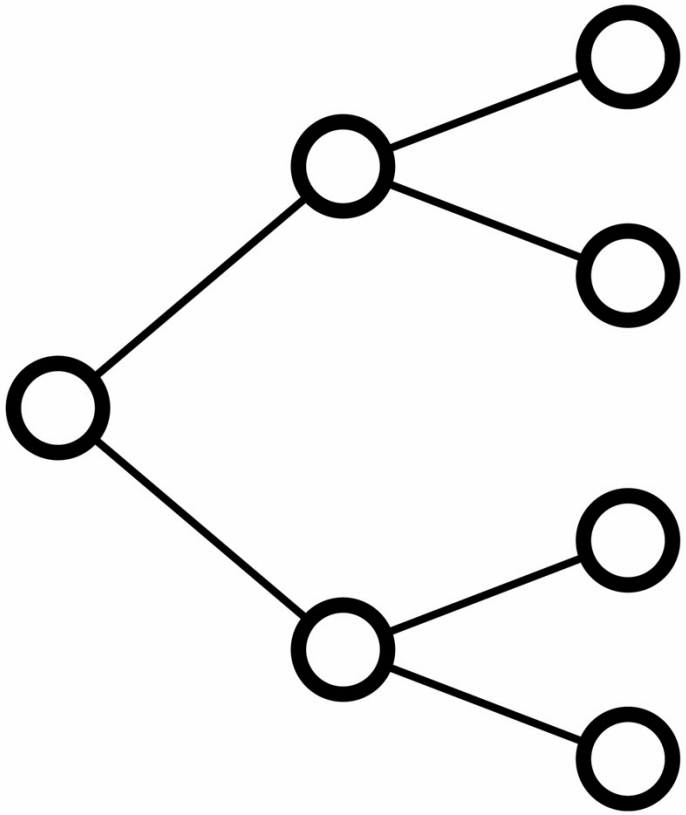
Sensitivity Analysis allows us to examine the variability from several inputs (# of units sold, price, initial investment, etc.) and its impact on a project's NPV.

We plot out the results for each input variable. The one with the greatest slope is the variable with the greatest impact on NPV.

Once the one or two high impact variables are identified, the next step is to create a Risk Management Plan to make sure the estimates are as accurate as possible, and actionable measures are employed if the downside conditions become reality.

Next Time…

Decision Tree 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 9: Probability tree diagram in mathematic by Zizo, Adobe Stock (499606074.jpeg).