Project Controls EXPO London, UK

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Are Triangles The Future?

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QINETIQ

QINETIQ/PUB18/04122

About the Speaker –

Ben Fry MEng MAPM

- Worked in Project Controls for the past 15 years;
  - Specialised in Risk Management and Quantitative Risk Analysis (QRA)
- Worked in a range of domains and organisations;
  - Submarines, Air, Land, Sea, Logistics, Construction
- Recently worked on Hinckley Point C (HPC);
  - Risk Manager for a £1.4Bn element of the project
  - Responsible for QRA across HPC
- Currently Principal Risk Management Consultant and Team Leader at QinetiQ;
  - Leading risk management improvement for a £0.5Bn programme

About QinetiQ

Air and Space

Maritime, Land and Weapons

North America

Cyber, Information & Training

OptaSense®

International

About The Topic

- Having the right amount of contingency is critical to businesses;
  - Too much – you risk losing the work to a cheaper competitor
  - Too little – you risk delivering late or even making a loss

- Many organisations use Monte-Carlo simulations to help determine contingency;
  - Technique that allows you to simulate running the project 1000's times
  - Builds up a statistical understanding of how our project will run
  - Dominance of "Triangular Distributions" in these models

Are the use of these Triangular distributions detracting or enhancing the validity of models underpinning our decision making?

Overview

- Monte-Carlo overview
- What is a 3 Point Estimate (3PE) and why might it impact model accuracy?
- Mock examples of a 3PEs impact on a Monte-Carlo model
- Case studies to understand the impact of 3PEs on real decisions

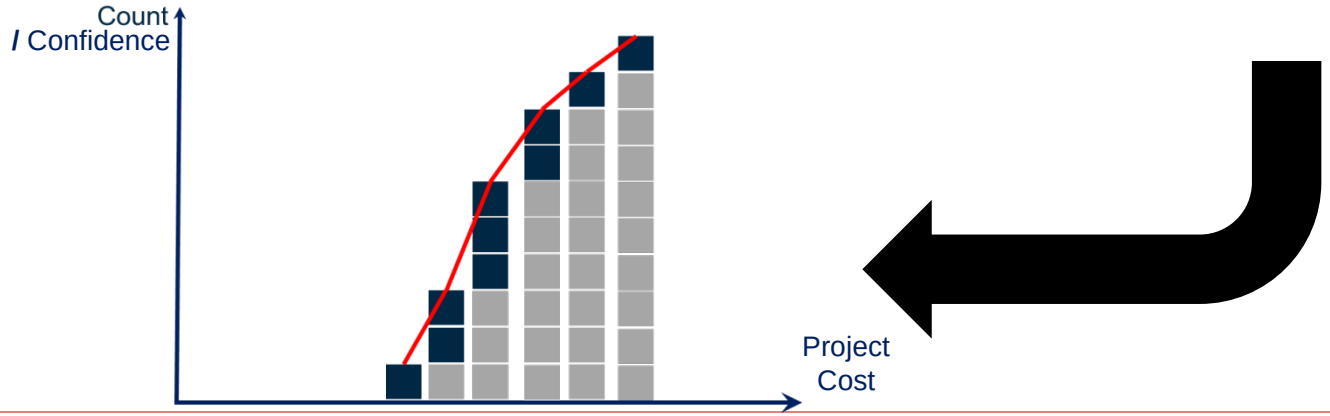
How Does Monte-Carlo Simulation Work?

Inputs

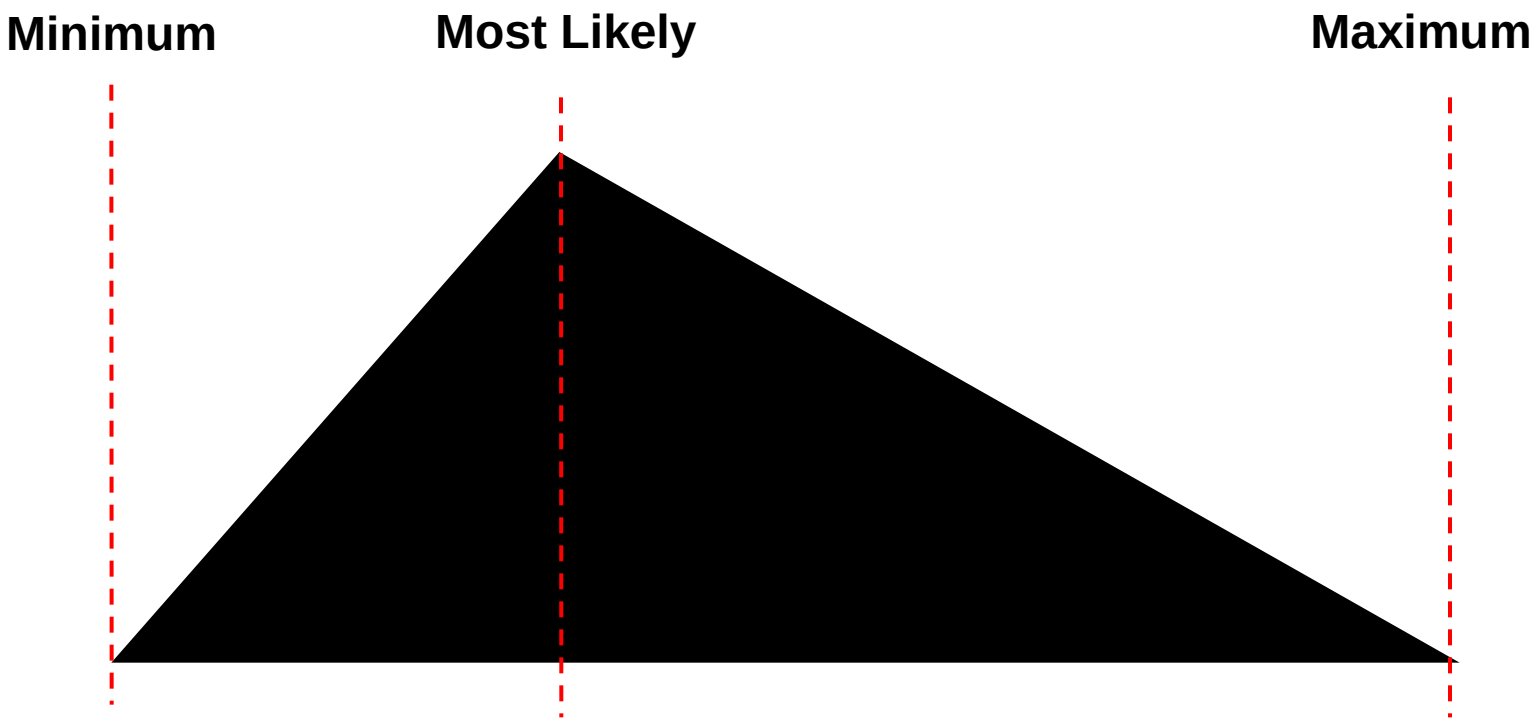
		3 Point Estimates		
	Prob	Min	ML	Max
Risk A	70%	£10	£12	£20
Risk B	50%	£15	£15	£30
Risk C	25%	£5	£10	£20
Risk D	40%	£40	£50	£60
Risk E	50%	£10	£30	£35

Outputs

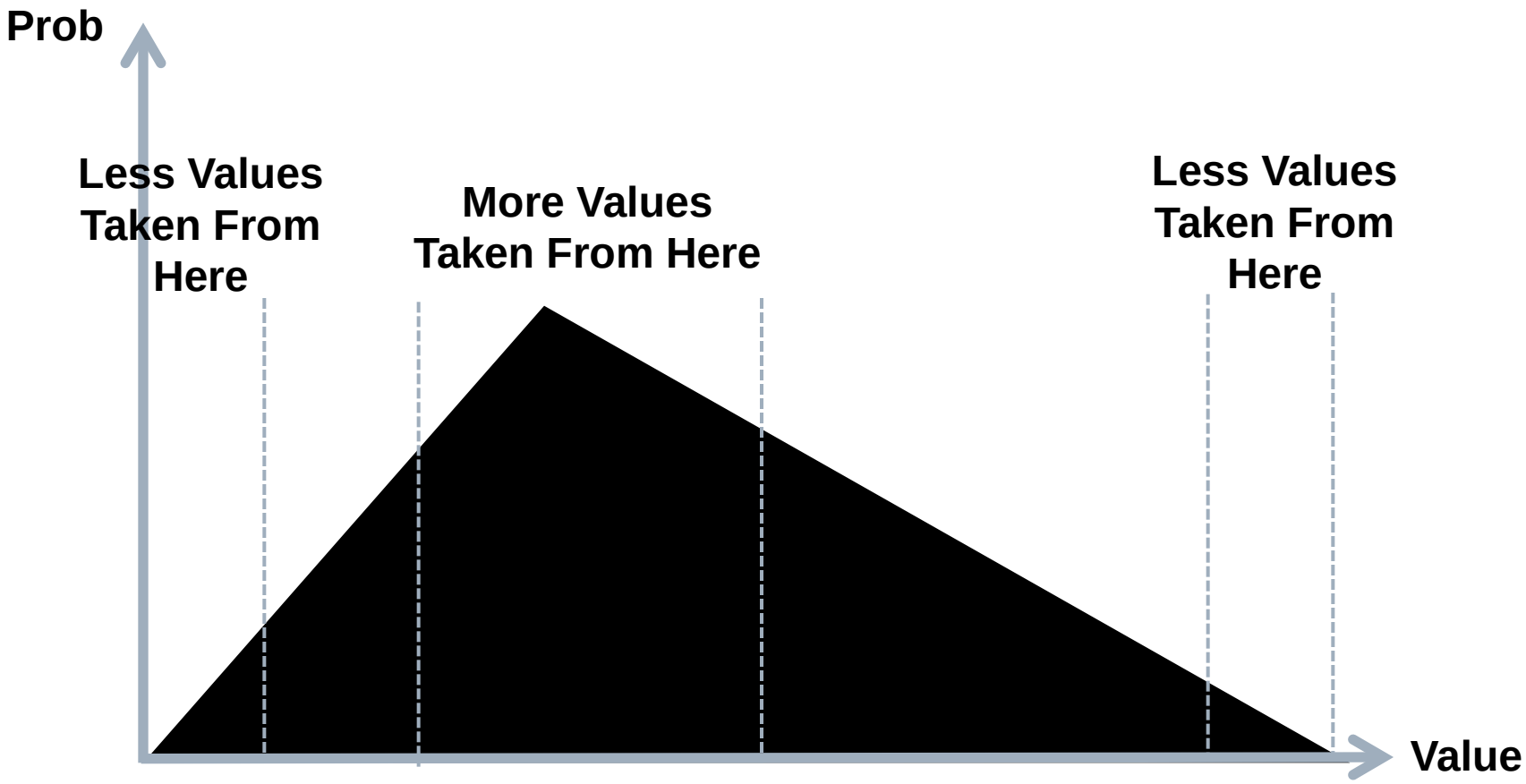
Iteration 1	Iteration 2	Iteration 3
£14	£19	£11
£0	£15	£0
£0	£0	£17
£48	£52	£0
£0	£15	£32
£62	**£101**	**£60**



3 Point Estimates – Triangular Distributions



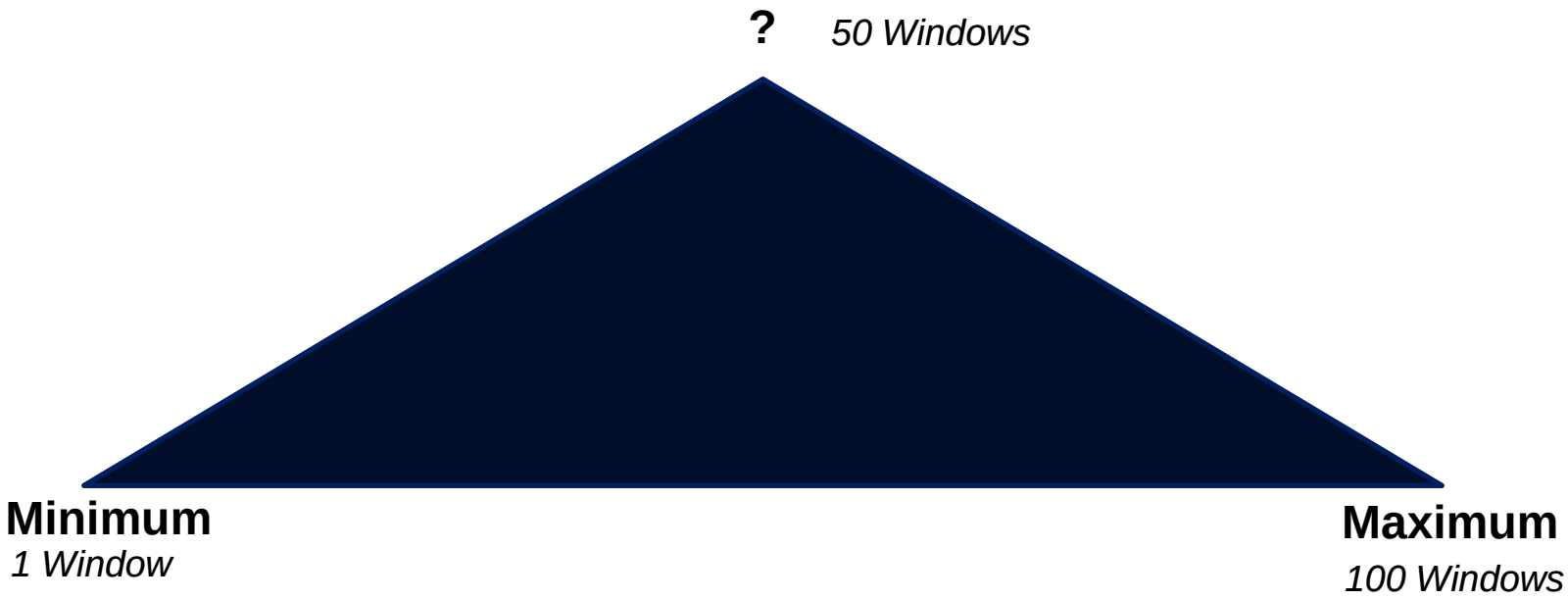
3 Point Estimates - Triangular Distributions



Example – Building Refurbishment Risk

- We are preparing a bid for the refurbishment of an office block in the US
- We know very little about the building or its condition;
  - We have a basic schematic but no survey information (100 Windows)
  - Our cost and schedule has assumed that the windows will not require replacement
- There is a risk that some or all of the windows will require refurbishment
- How much could this risk increase our costs by if it occurs?

Example – Building Refurbishment Risk



2 Point Estimates - Uniform Distributions

What Is The Best Distribution?

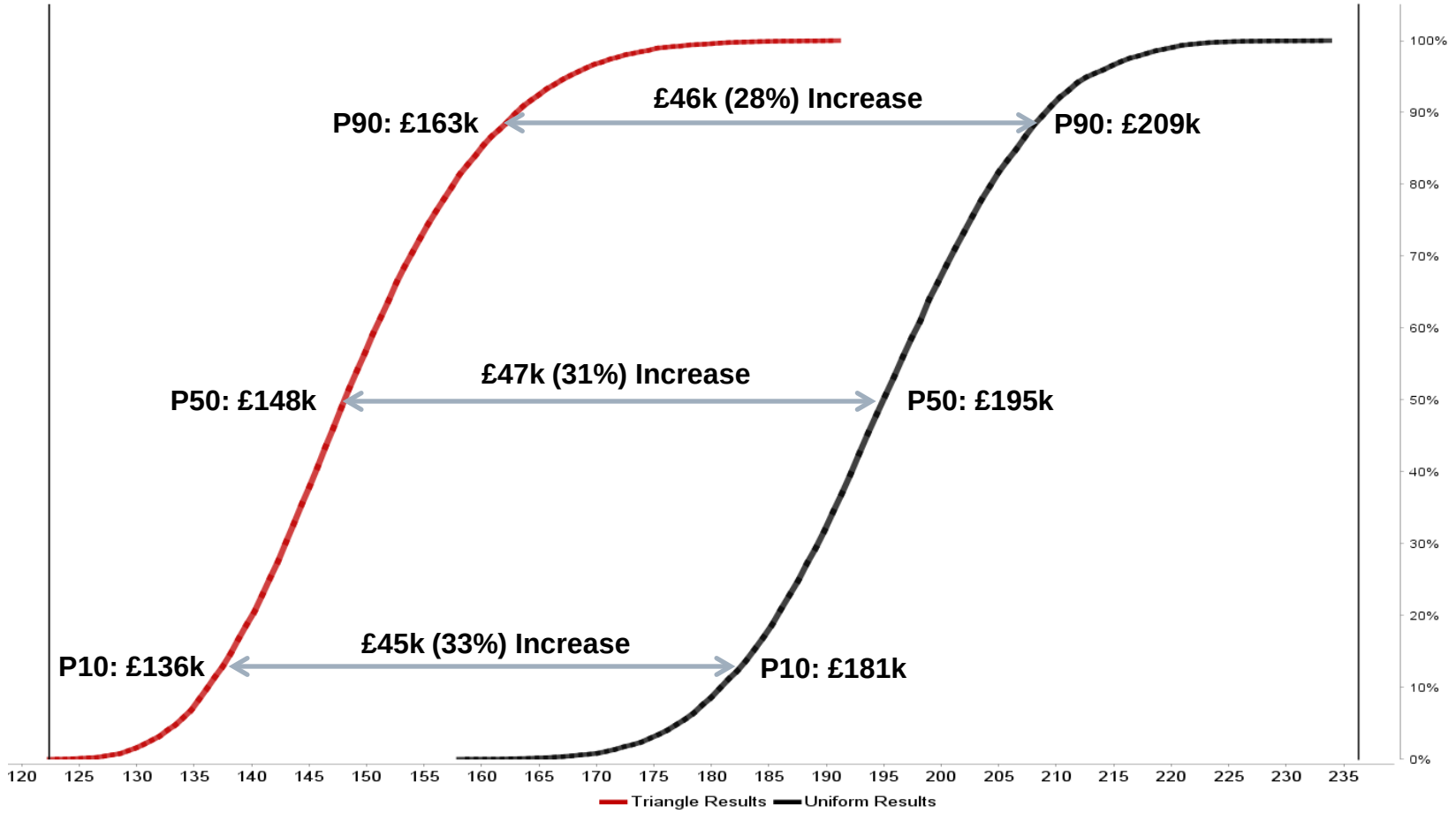
Depends on the information we have!

So What? – Mock Case Study

Estimating Uncertainty	Min (£k)	Most Likely (£k)	Max (£k)
Foundations	30	35	50
Structure	50	52	55
Roof	5	8	12
Glazing	7	8	15
Plumbing	5	6	20
Electrical	2	4	8
Finishing	8	12	25
Inspection	1	2	10

Risks	Prob	Min (£k)	Most Likely (£k)	Max (£k)
There is a risk of planning permission rejection resulting in redesign.	15%	10	12	20
There is a risk of unexpected ground conditions leading to remedial work	20%	8	10	15
There is a risk that the glazing suppliers become insolvent.	5%	7	8	15
There is a risk that the new formula paint doesn't provide required finish	30%	1	2	3
There is a risk that changes in legislation make it illegal to install the electrical system that has been purchased.	10%	2	3	6

So What? – Monte-Carlo Outputs



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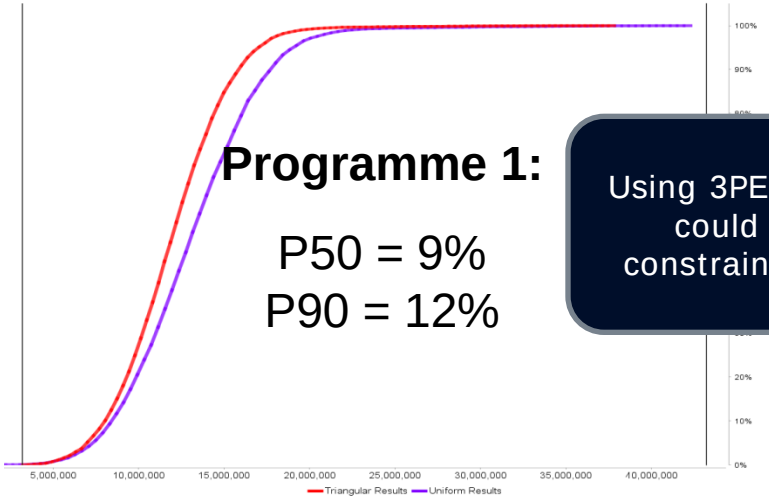
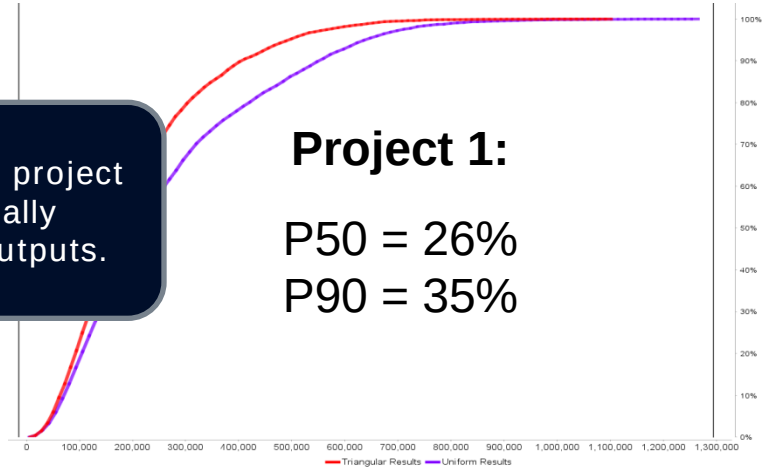
Real So What? – Actual Case Studies



Programme 1:

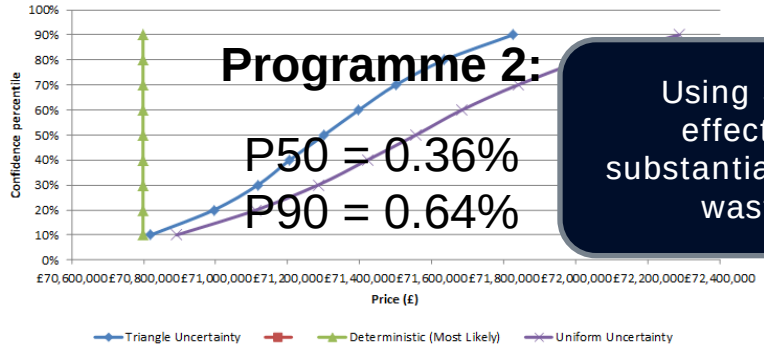
P50 = 9%
P90 = 12%

Using 3PE on these project could be artificially constraining the outputs.



Project 1:

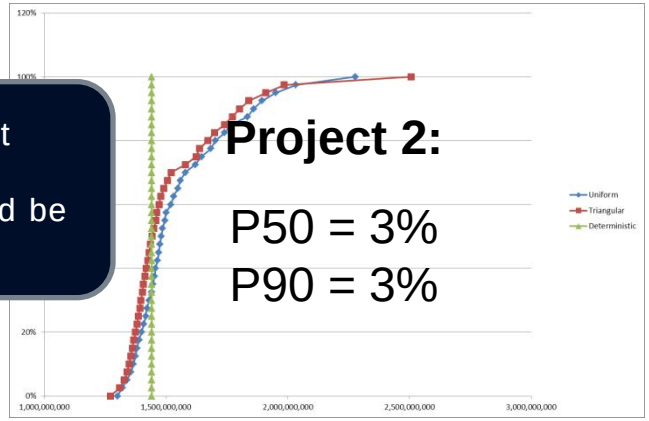
P50 = 26%
P90 = 35%



Programme 2:

P50 = 0.36%
P90 = 0.64%

Using 3PE on is not effecting outputs substantially, but could be wasting effort.



Project 2:

P50 = 3%
P90 = 3%

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Are Triangles The Future?

- True maturity is;
  - Understanding what information you have and determining if a 3PE is the best way to build a model.
  - Not assuming that all model inputs require a 3PE and that a 2PE is less mature.
- **Only adopt a 3 Point Estimate (Triangular or otherwise) where we have sufficient information (or knowledge) to define a credible Most Likely**
- Challenge whether for small projects we can justify the effort in producing a 3 Point Estimate or if 2 points are sufficient

Any Questions?

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