

Risk Savvy Finance

Government Finance Officers Association



“Without numbers, there are no odds and no probabilities; without odds and probabilities, the only way to deal with risk is to appeal to the gods and the fates. Without numbers, risk is wholly a matter of gut.”

-Peter Bernstein, *Against the Gods: The Remarkable Story of Risk*

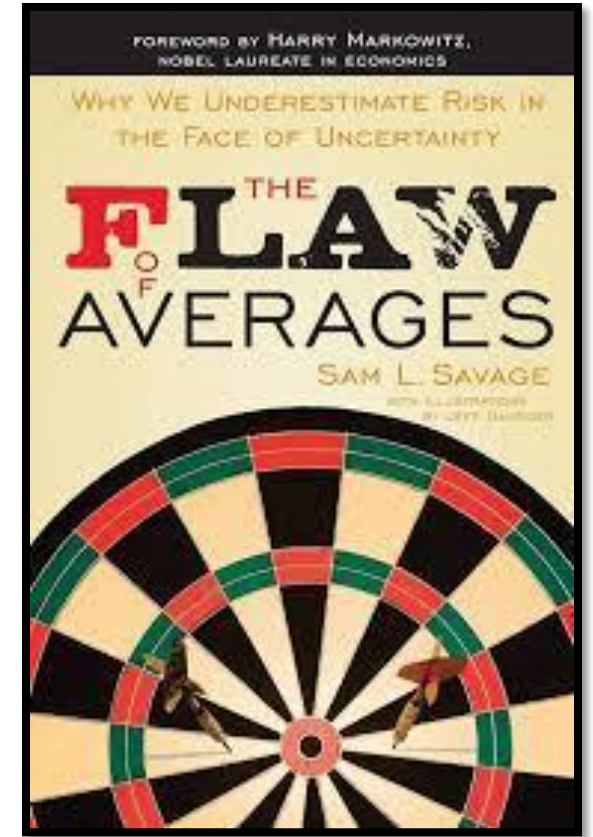
We don't assume any statistical knowledge.

For those with extensive training it will take only a few minutes to repair the damage.

Post Traumatic Statistics Disorder (PTSD)

The Flaw of Averages

Plans Based on Averages Are Wrong on Average

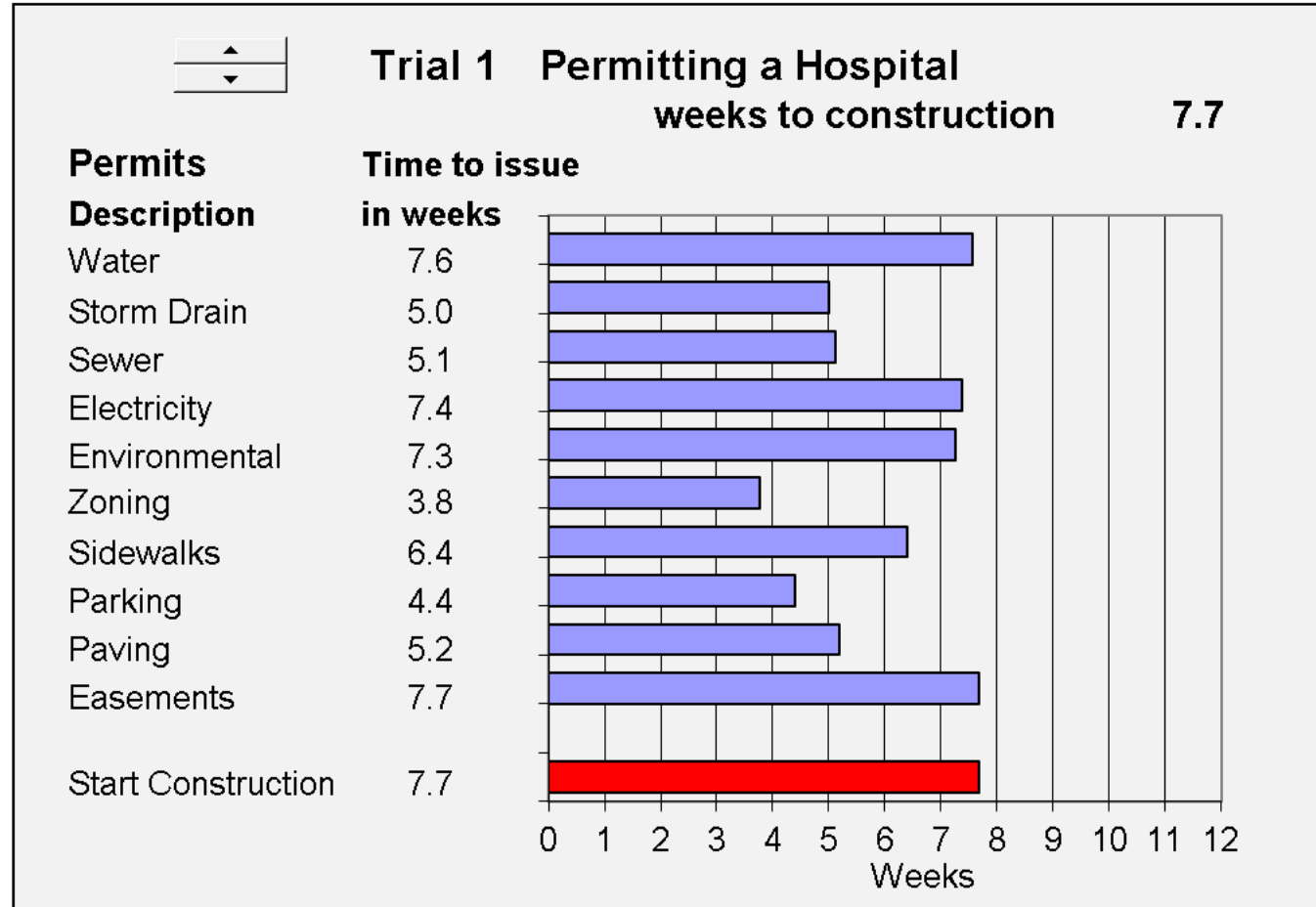


Probability
Management





Schedule





The Arithmetic of Uncertainty

Arithmetic tells us that X plus Y Equals Z

The Arithmetic of Uncertainty says
what do you want Z to be?

Here are your chances!



A Mindle is to the Mind what a Handle is to the Hand

It helps you grasp a slippery subject

The Four Mindles of Arithmetic

+ - X ÷

The Five Mindles of the Arithmetic of Uncertainty

1. Uncertainty vs. risk
2. Uncertain numbers
3. Combinations of uncertainties
4. Plans based on uncertain assumptions
5. Interrelated uncertainties



Mindle 1 - Uncertainty vs. Risk

Is there a Risk that XYZ Stock will go down tomorrow?

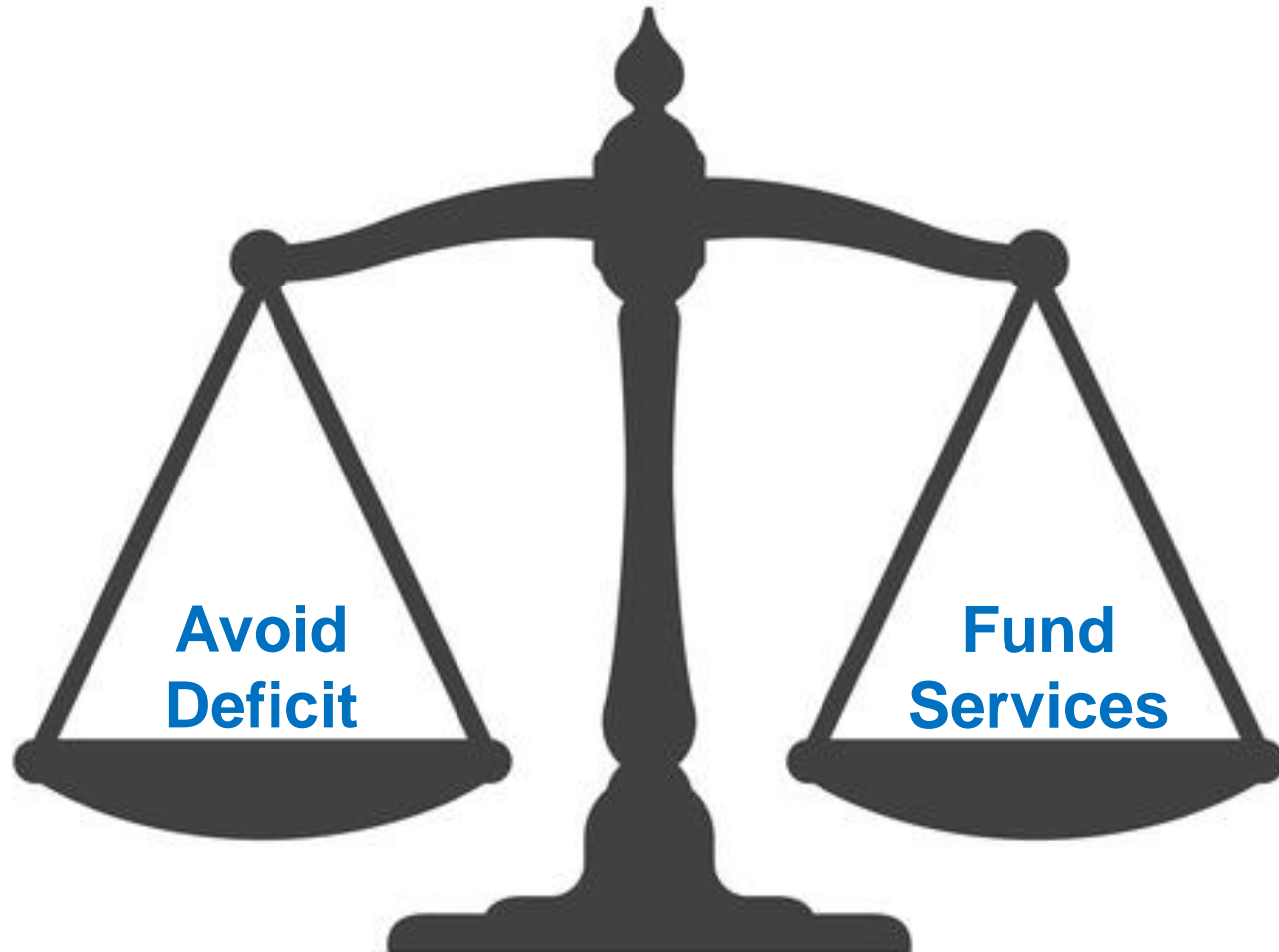
Heck no! I've shorted XYZ.

The Risk for me is that XYZ goes up!

Risk is in the eye of the Beholder



Conservative vs Objective Forecasting



Two Perspectives on Risk

Perspective 1

The risk is that forecast is **too conservative**, which means we can't allocate enough money to important services.

Perspective 2

The risk is that the forecast is **too aggressive** and end up with a deficit at the end of the year when revenues underperform the forecast

Later we'll show you a tool to help thread this needle



Take Away Idea:
Make objective forecasts and
conservative budgets

Mindle 2

Uncertain Numbers are Shapes



Let's Start with a Very Basic Uncertainty...

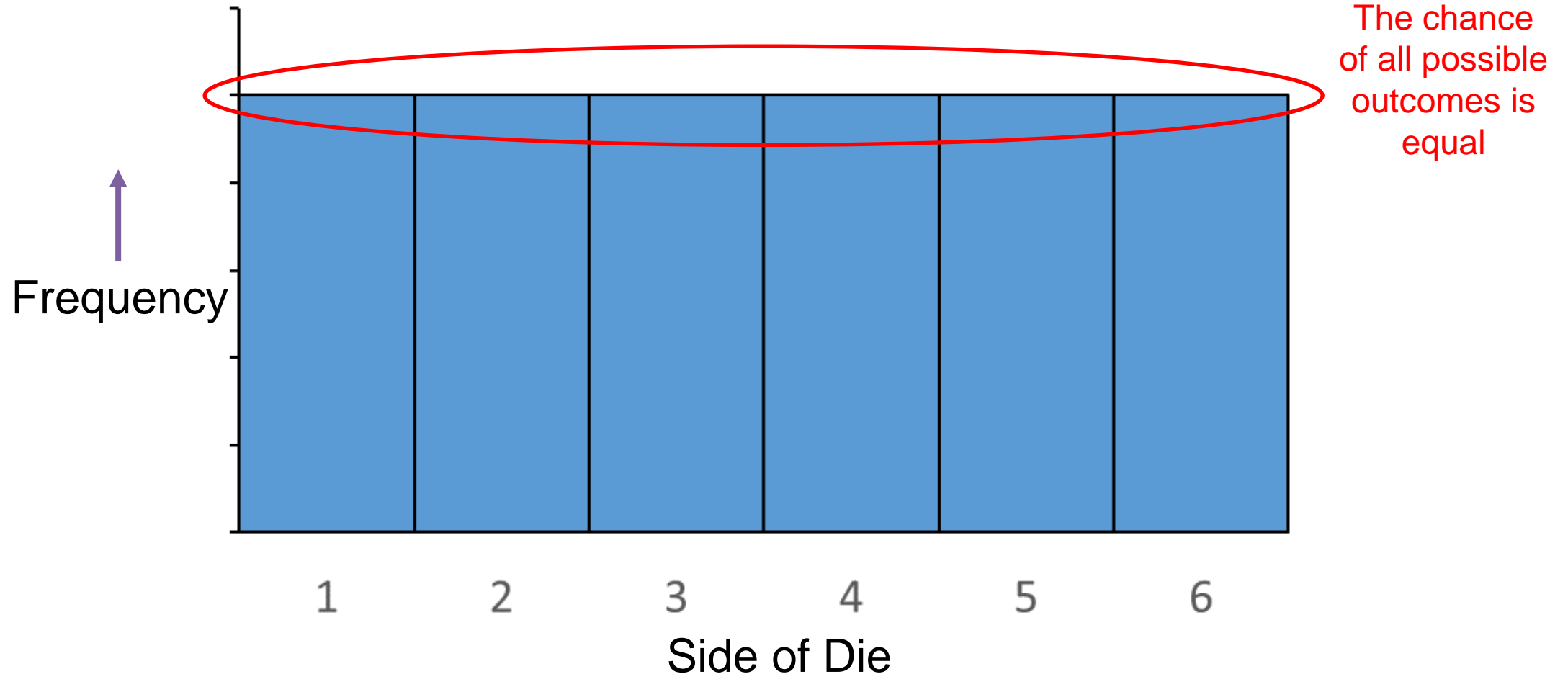


The chance of getting a “six” on single throw of a fair die is 1 in 6 or 16.67%...

...but what does that look like as a picture?



Single Die Histogram*



This shape is relatively rare in the uncertainties we are concerned with. Let's see those shapes and where they come from

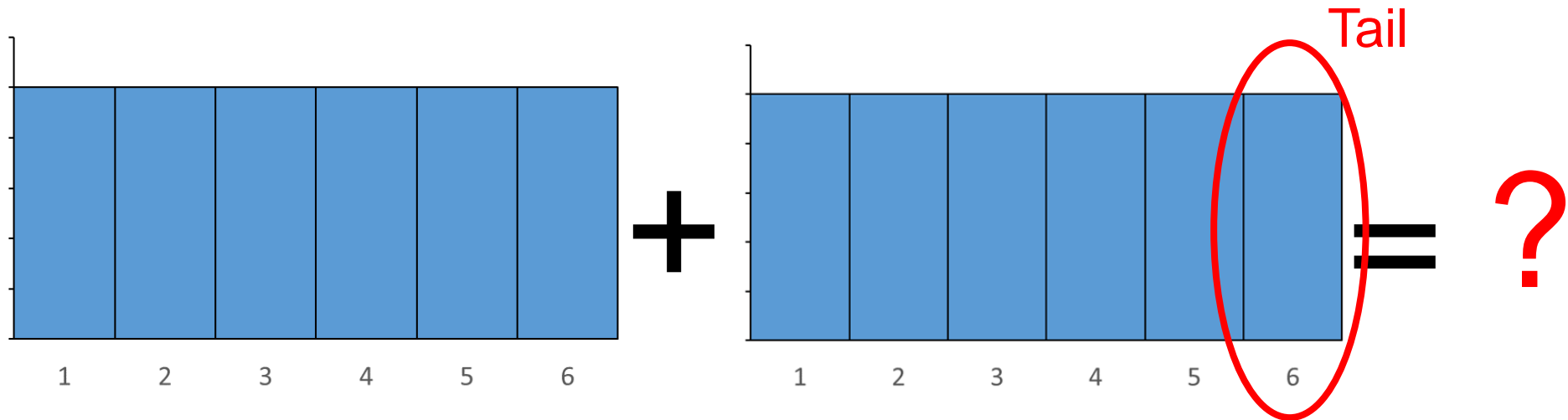


Take Away Idea:
Represent uncertainty graphically

Mindle 3

Combination of Uncertain Numbers

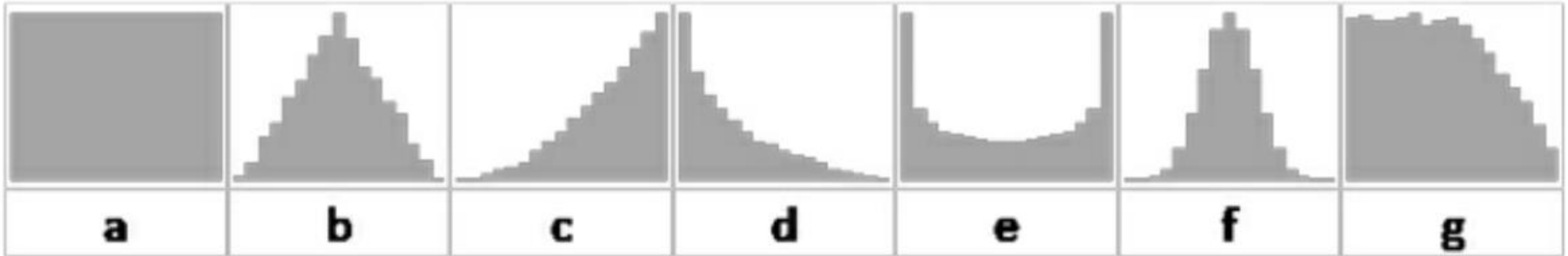
Let's Revisit Our Dice



*Dice example provided courtesy of Sam Savage author of *The Flaw of Averages*.

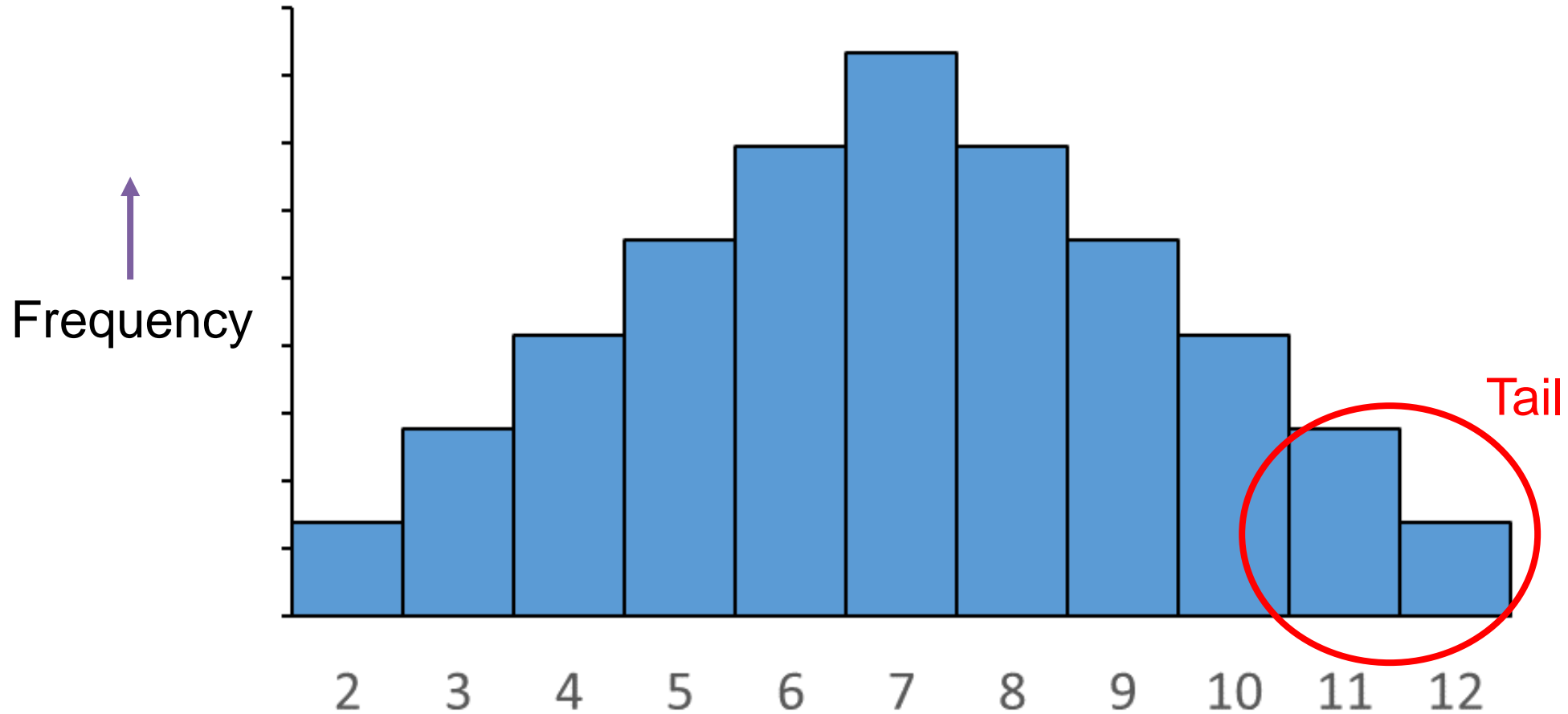


What's Your Choice?





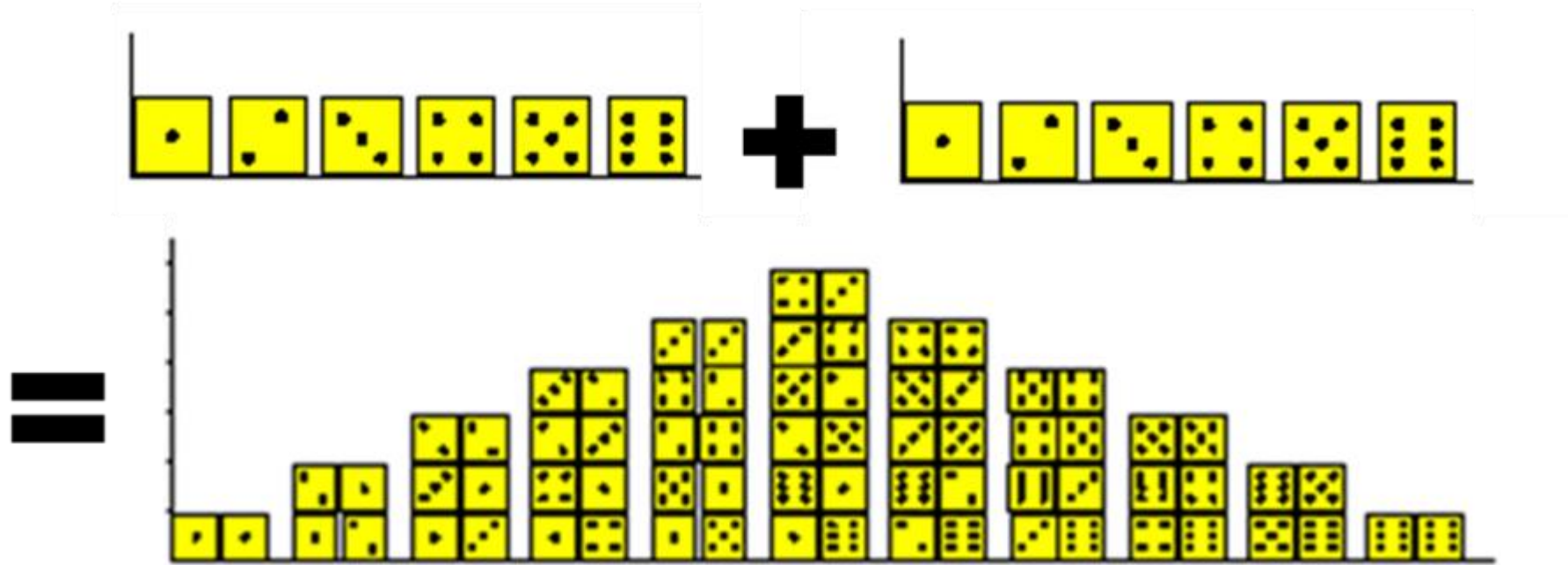
The Surprising Answer*...



*Dice example provided courtesy of Sam Savage author of *The Flaw of Averages*.



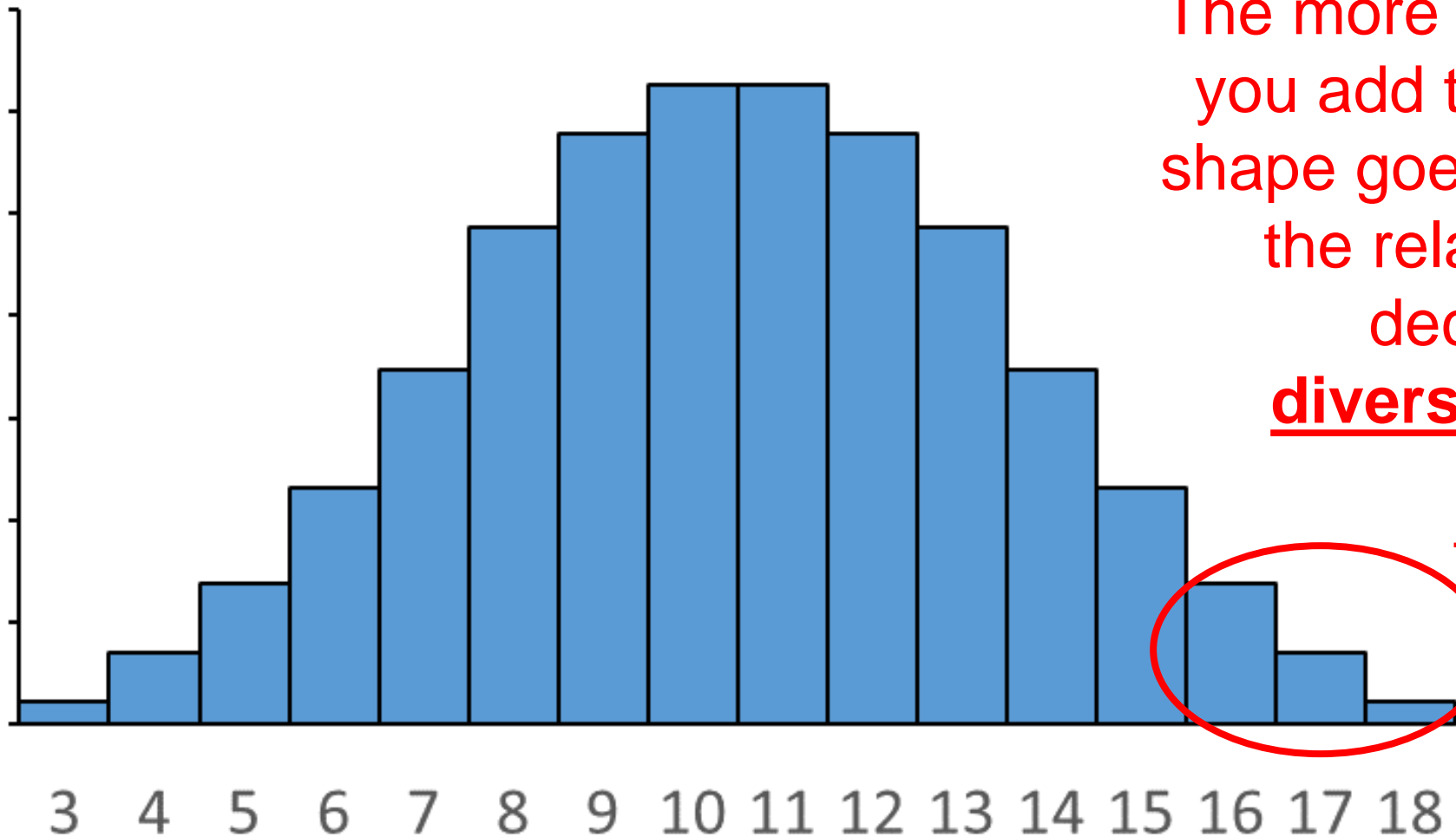
A Visual Explanation*



*Dice example provided courtesy of Sam Savage author of *The Flaw of Averages*.



What about Three Dice?

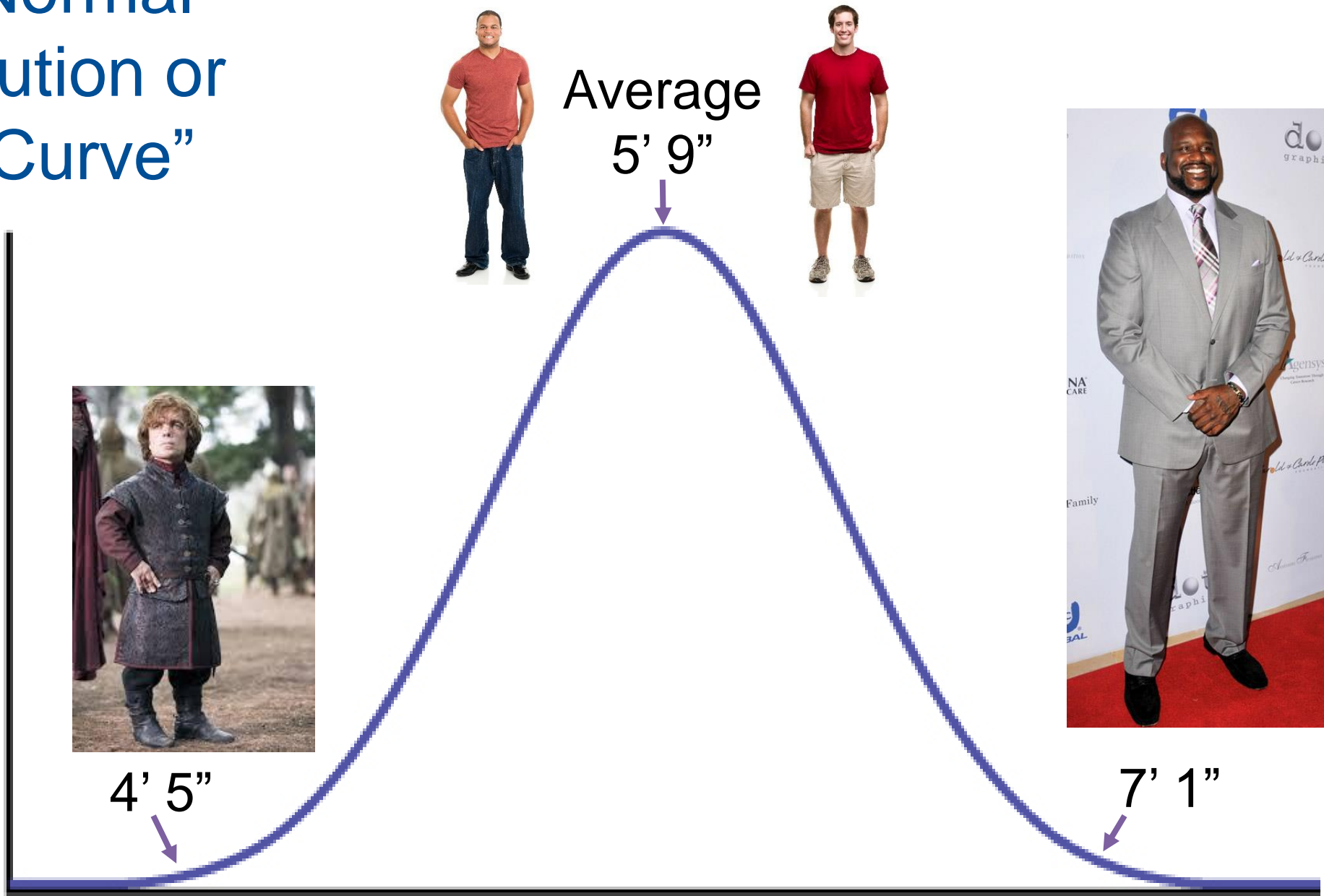


The more shapes (uncertainties) you add together the more the shape goes up in the middle and the relative size of the tail decreases. This is **diversification** in action.

Tail

The Normal Distribution or "Bell Curve"

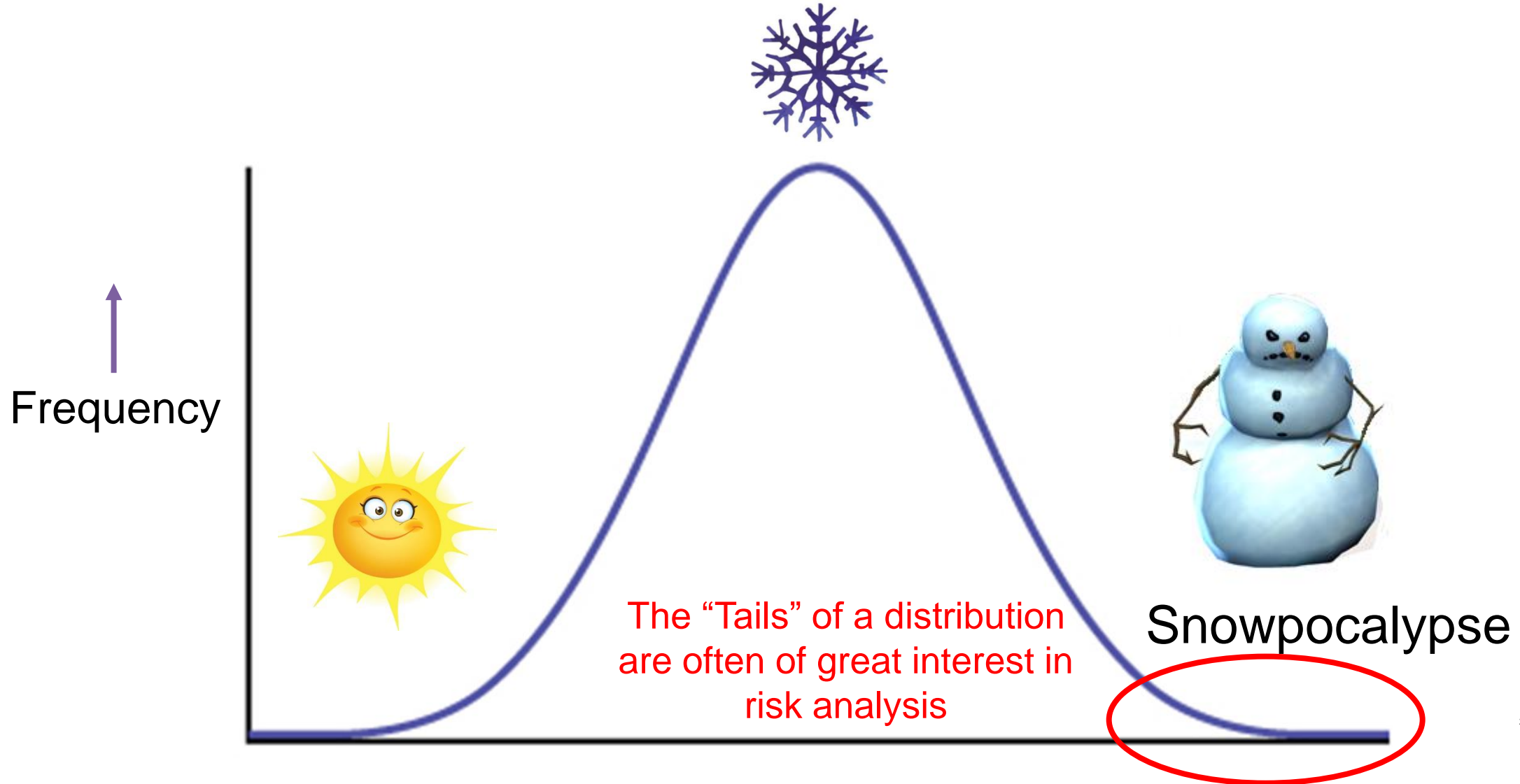
↑
Frequency



Height →



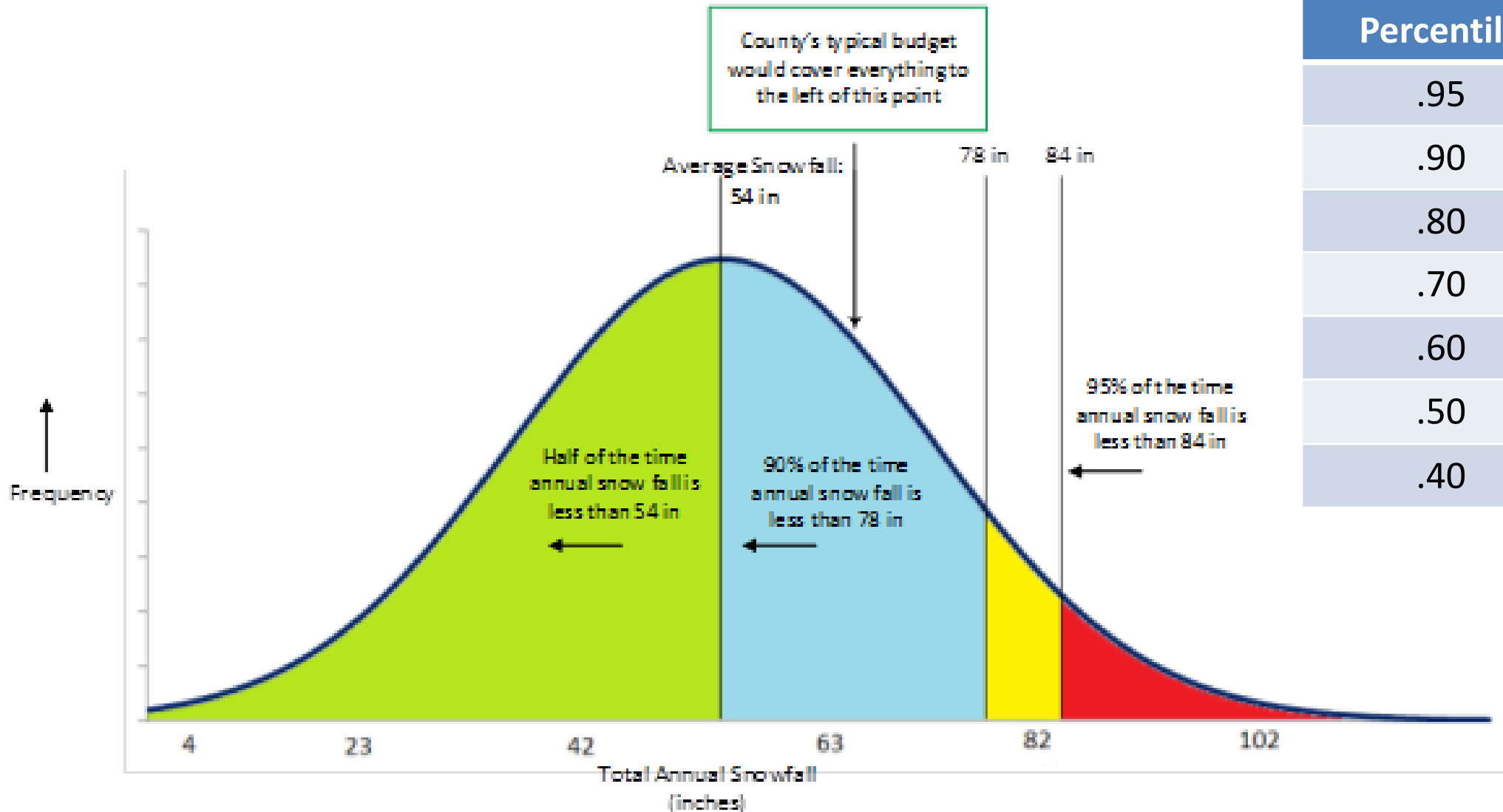
Normal (Symmetrical) Distribution in Local Govt





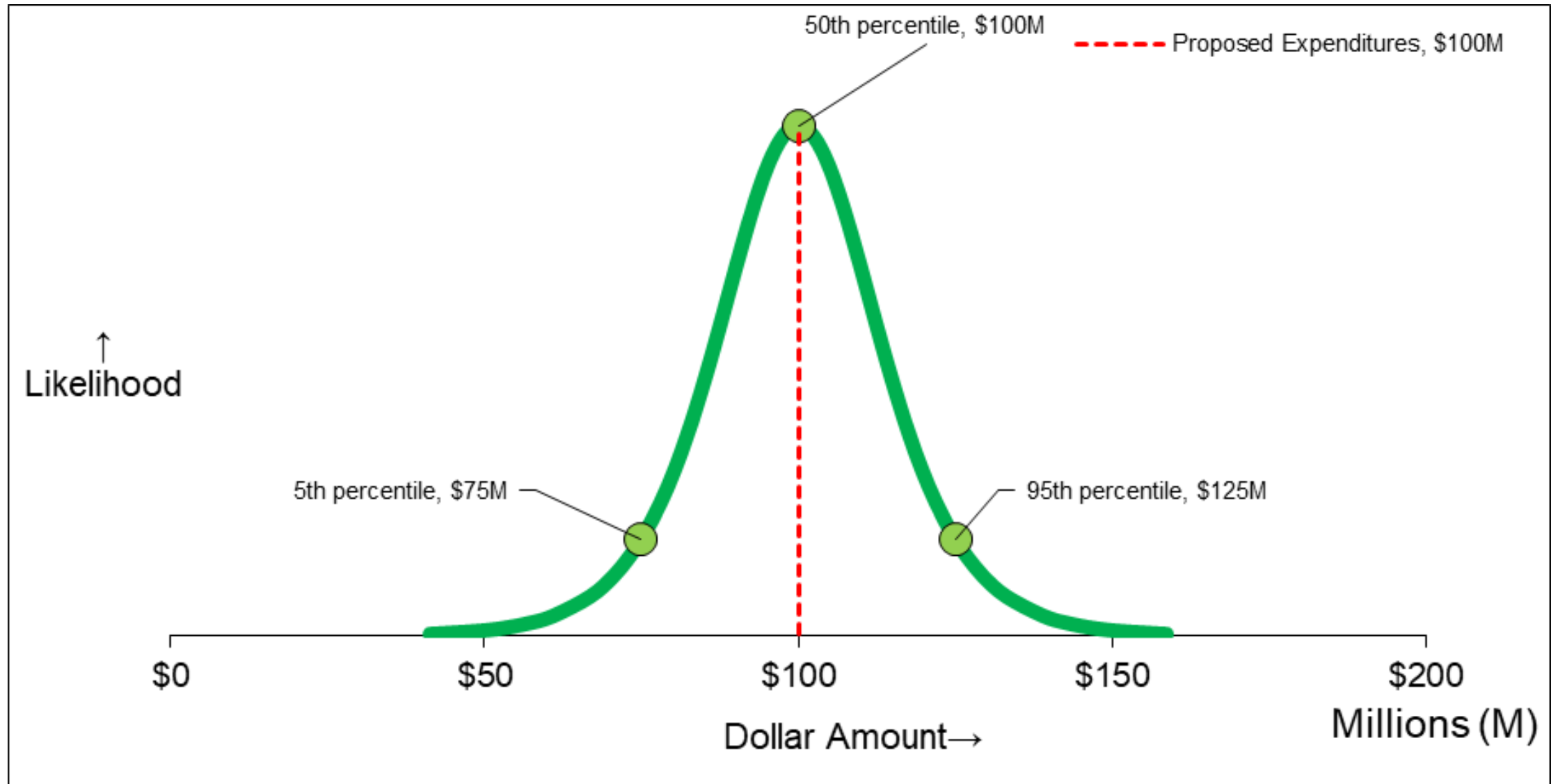
Normal Distribution Applied to a County

| Percentile | Snowfall |
|------------|----------|
| .95 | 84 |
| .90 | 78 |
| .80 | 70 |
| .70 | 64 |
| .60 | 59 |
| .50 | 54 |
| .40 | 49 |





We Can do the Same for Forecasts





Take Away Idea:

Uncertain numbers like forecasts will usually have tails. Plans can be developed to protect against tail risk.

Mindle 4

Plans Based on Uncertain Numbers

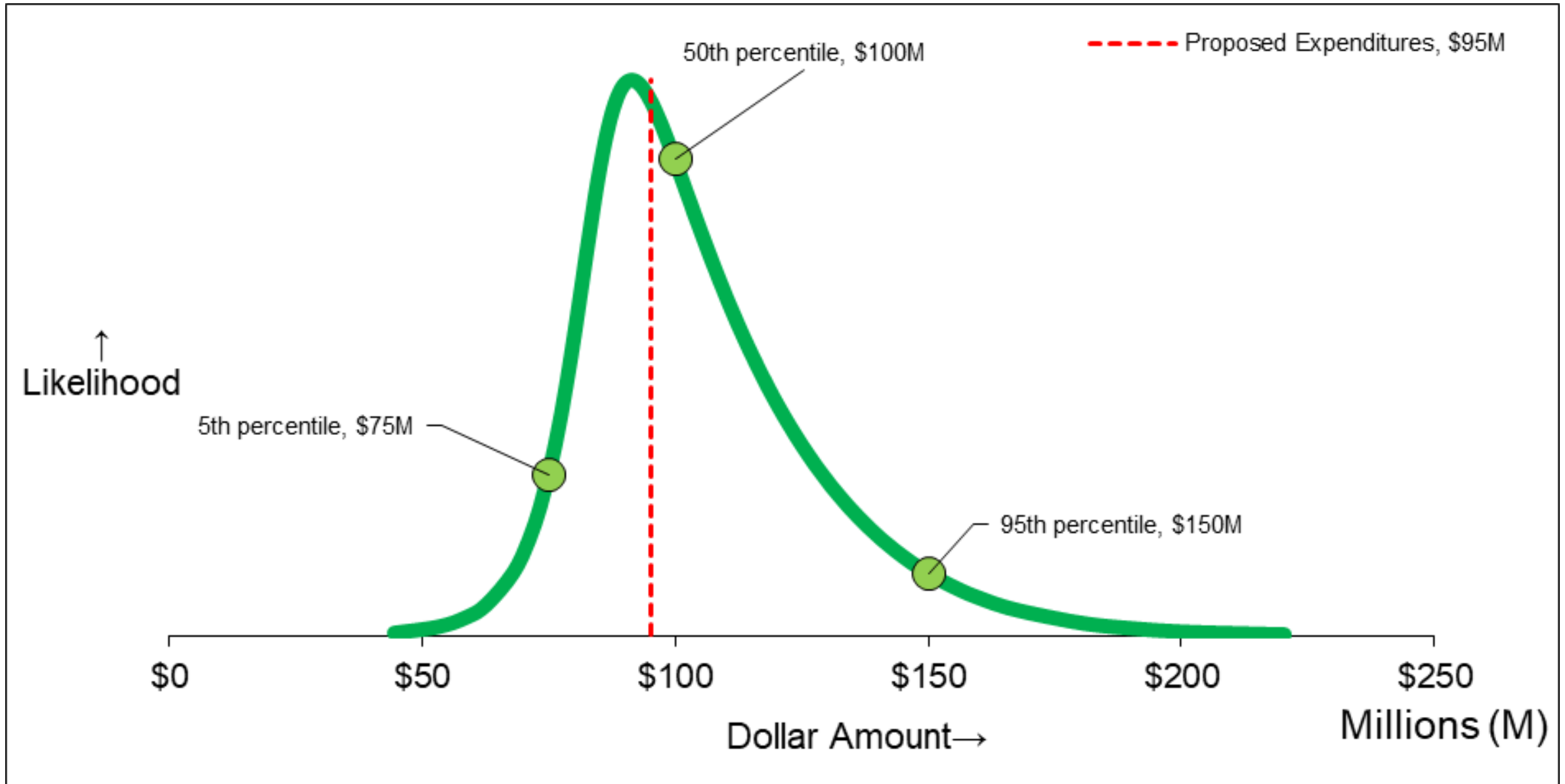


How Does this “Flaw of Averages” Apply to a Forecast?

In the “average” version of the future, the forecast might be fine but...

We can't forget the uncertainty!

Let's See a Model





Take Away Idea:
Make risk savvy forecasts and plans
with computer simulation models

Mindle 5

Interrelated Uncertain Numbers

Let's Go from...

Dice...



...to Dominoes



Interrelated risks are like dominoes, if one goes they all go



Vulcan, the Fire God ravages each of two cities each year by rolling a die for each city, then determining the fire damage by multiplying by \$1 million. Each city has reserves to cover a \$5 million fire, but \$6 million would be financially disastrous.

- A. What is the chance of disaster for each city?
- B. What is the chance for each city if they pool the risk?



Suppose Vulcan rolls a single die and unleashes the same damage on each city.

- A. What is the chance of disaster for each city?
- B. What is the chance for each city if they pool the risk?



Take Away Idea:

Know the difference between a truly diversified taxbase and one where the risks are interrelated.

The End

*GFOA's Informed Decision-Making through Forecasting:
A Practitioner's Guide*



*Get a Copy of the Mini-Stress
Test Model*

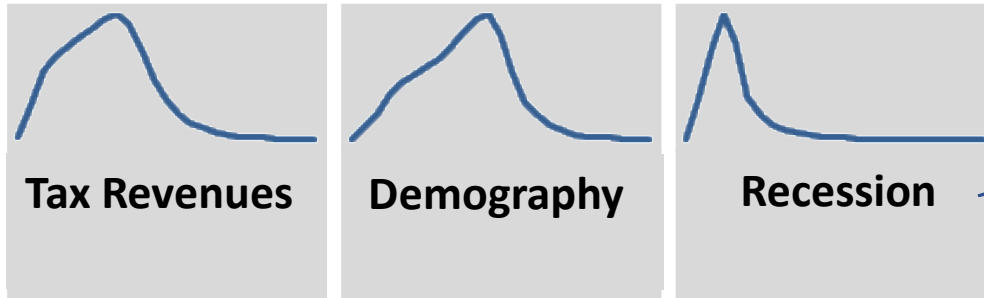


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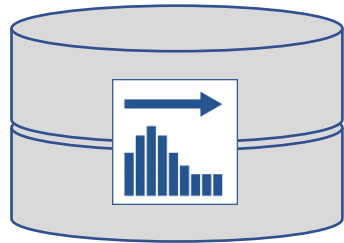


Probability Management

ProbabilityManagement.org is a 501(c)(3) nonprofit dedicated to making **Uncertainty Actionable** through tools, standards, applications, and training.



Uncertainties about ANYTHING



Can be stored ANYWHERE



And used ANYWHERE else