

Rethinking Reserves

Utah GFOA



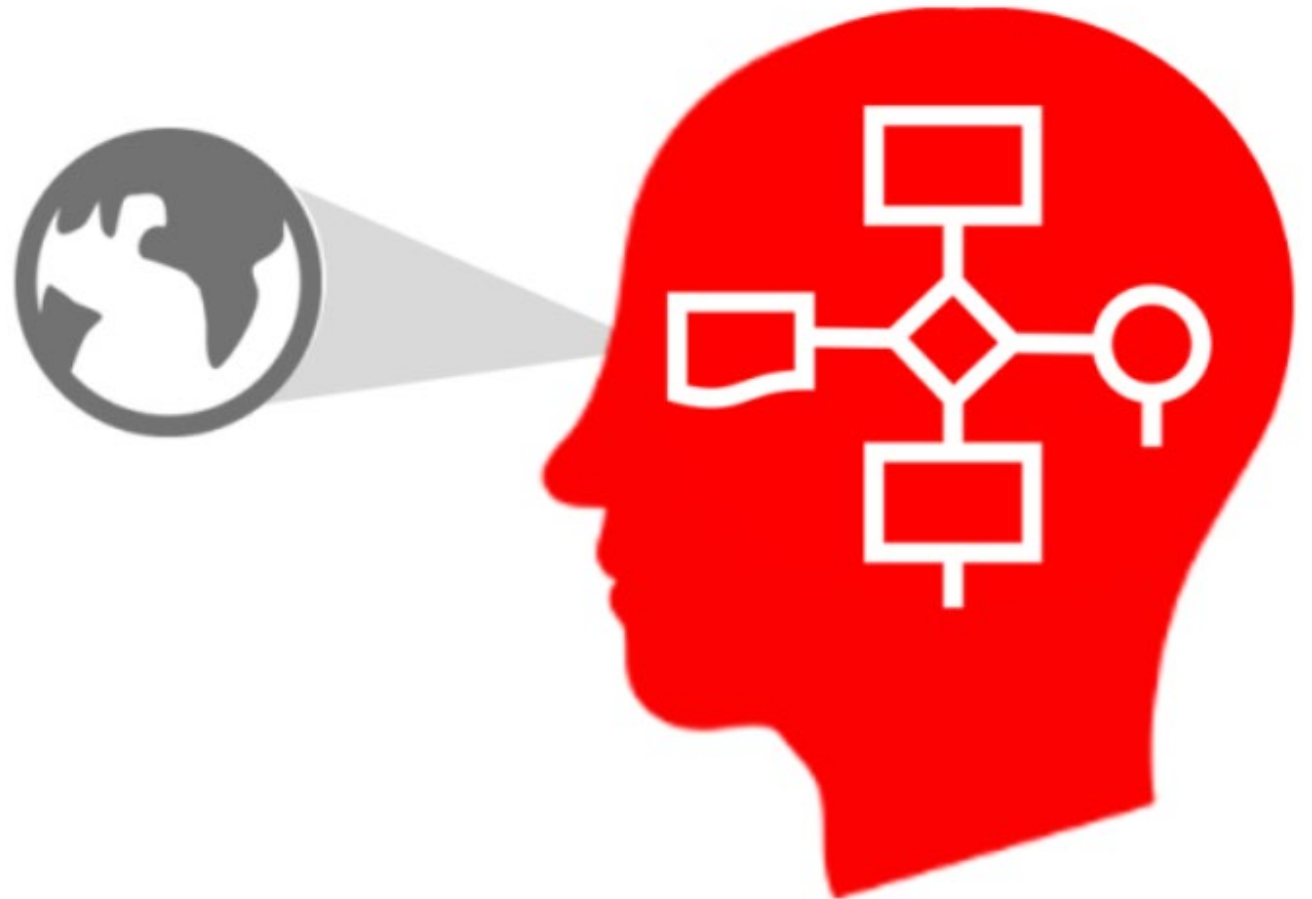
What are Reserves?

“Reserves” is a budget and policy term that describes the resources available *outside of the budget* for use if the resources appropriated *inside of the budget* are insufficient. This offers protection against **unplanned, unavoidable** costs or losses.

**A mental model is a
representation of
how the real-world
works.**

**The real world is
complicated.**

**Mental models
simplify.**



What is the Traditional Mental Model for Reserves?

The Savings Account

- Easy to grasp
- Seemingly obvious
parallel to our
personal lives



The Savings Account Mental Model is Limited

- Savings is more commonly seen as deferred spending than a way to manage risk
- Implies that more is better



What is the Alternative?

The Insurance Policy

- A reserve manages volatility
- Risk is a product of volatility
- Hence, reserves help manage risk

Advantages

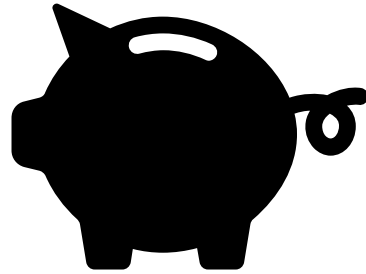
- Obvious parallel to personal lives
- Invites us to think how commercial insurance complements reserves
- Implies there is an optimal amount



**Reserves as
Insurance**



**Reserves as
Savings
Account**



**Savvy & Wise
Decisions**



How You Can Approach Risk Analysis



How Can You Analyze Your Risk?

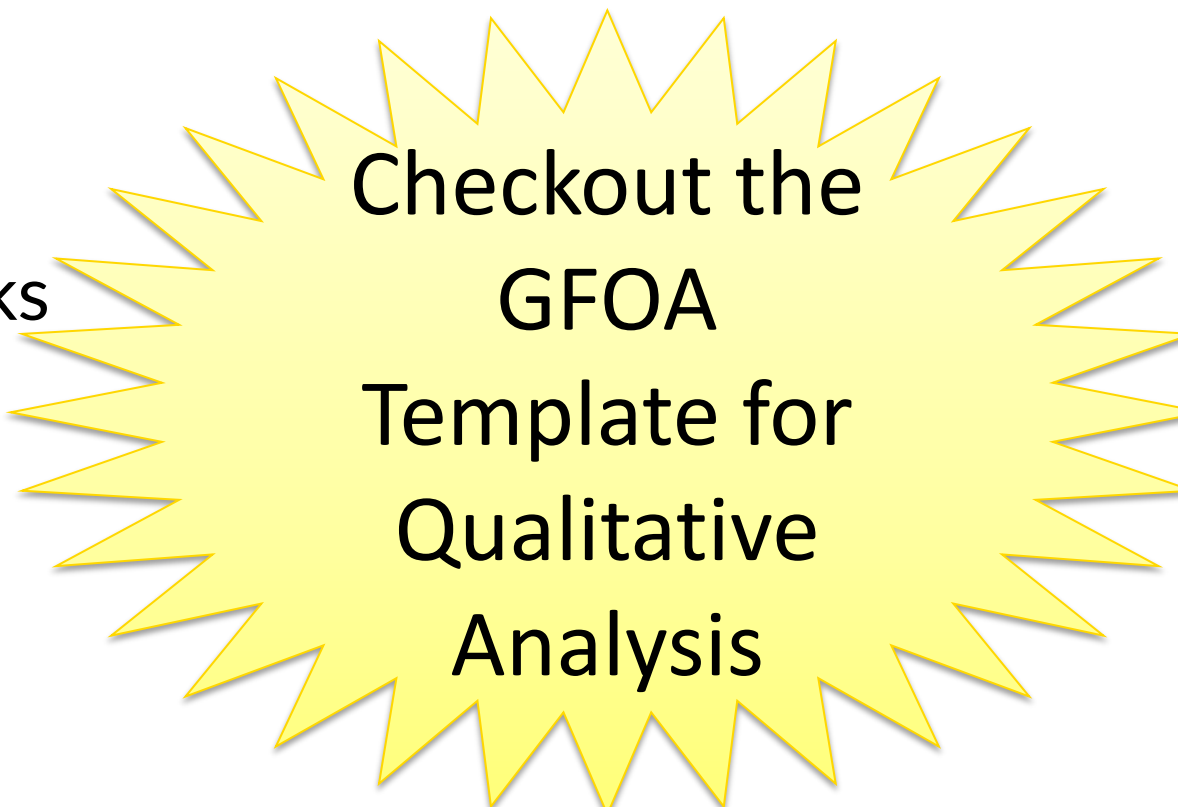
Three methods:

1. Qualitative Risk Analysis
2. Quantitative Analysis: **“Single Number”** Method
3. Quantitative Analysis: **“Chance-based”** Method

Qualitative

- Most accessible approach
 - Assess your exposure
 - Consider a range to accommodate exposure
- Pros
 - Easy!
 - Gets people thinking about risks
- Cons
 - Results are subjective
 - Raises chance of error

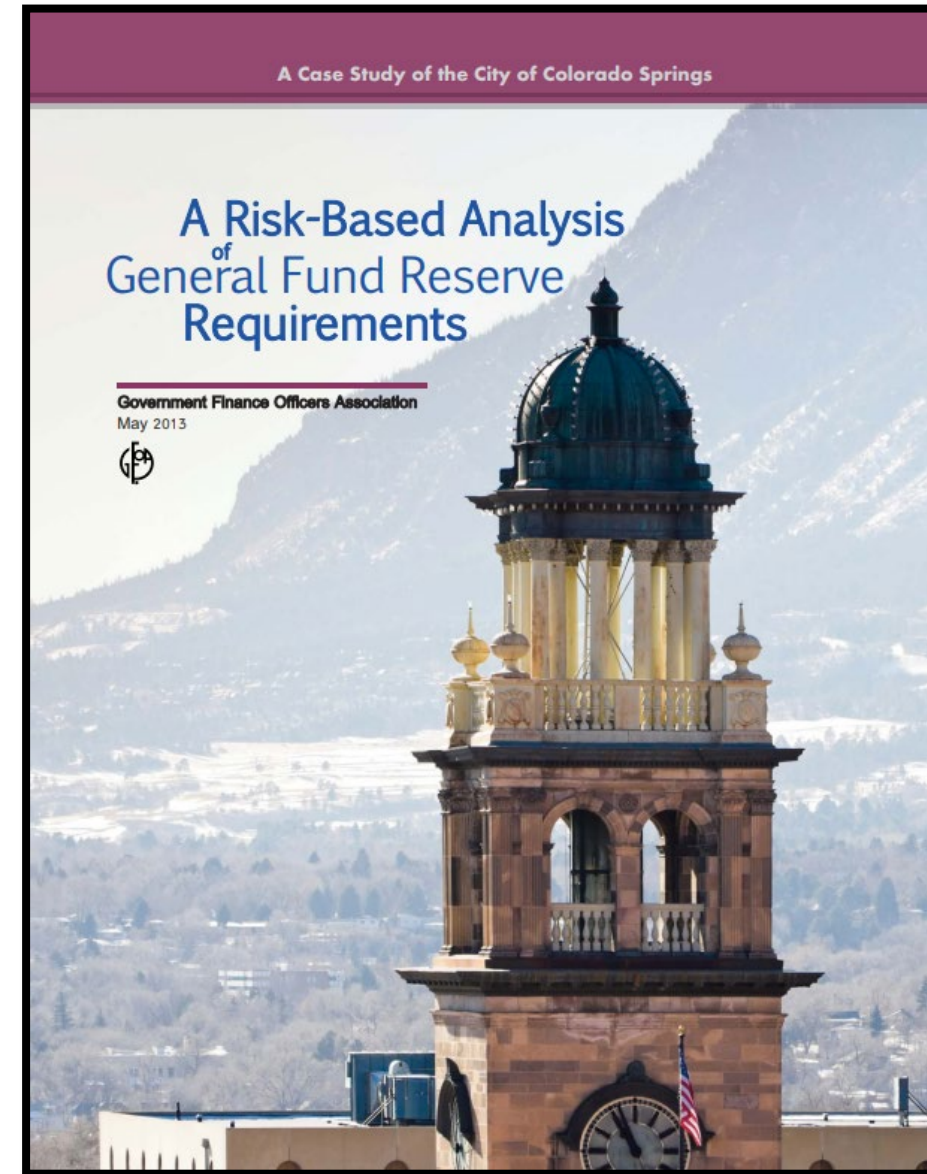
1	Very high
2	High
3	Medium
4	Low
5	Very Low



Checkout the
GFOA
Template for
Qualitative
Analysis

Quantitative with Single Number

- Recession risk
 - 2008 recession was a bad recession
 - Losses were \$5M
 - \$5M is probably sufficient for most future recessions
- Use history & analogues for estimates of potential loss
- Pro: Accessible
- Con: Risks are uncertain. Single numbers may be misleading



Risks aren't Additive

Likelihood of covering the extreme event	Hazardous Materials	Wildfires	Total (New Distribution of Total Risk)	Total (Simple Sum of Individual Risks)
90%	\$3.1 million	\$2.5 million	\$4.7 million	\$5.6 million
95%	\$3.5 million	\$2.8 million	\$5.2 million	\$6.3 million
99%	\$4.1 million	\$3.2 million	\$6.1 million	\$7.3 million

Quantitative: Chance-based

- Same methods used by insurance companies
- Risk is not condensed to a single number
- Rather, the full range of variation is used
- Pros
 - Provides best estimate of optimal reserve range
 - Best way to take advantage of “power tools” of risk aware thinking
 - Technology makes is more practical than ever before
- Cons
 - Requires special training and consulting support





Probability Management



Tools for Thinking About Risk

A Complete Definition of Risk*

The probability and magnitude of a loss, disaster, or other undesirable event



*Definitions on this and previous slide from Doug Hubbard in *The Failure of Risk Management*

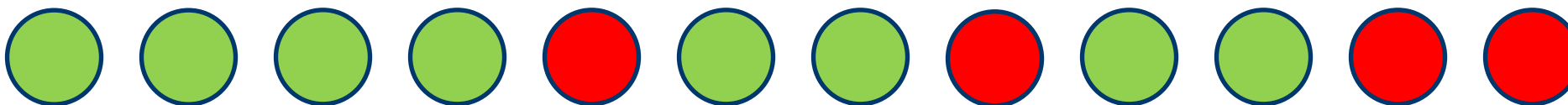
Why We Need Probabilities

“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.”

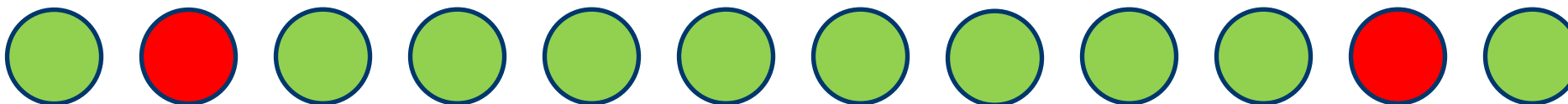
-Peter Bernstein, *Against the Gods: The Remarkable Story of Risk*



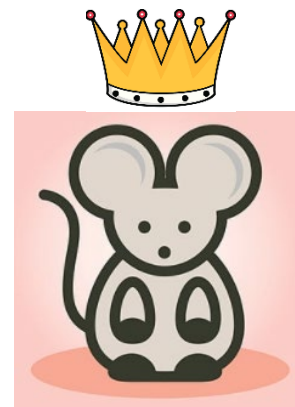
Why Not Go With the Gut?



What will the next color be?



vs.



Tool 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

A Reserve Helps Manage Uncertainty

But how much is enough?





Two Perspectives on Risk

Perspective 1

The risk is that reserves are too low and we are unable to respond to an emergency situation

Perspective 2

The risk is that reserves are too high and we miss an opportunity to use reserves to create better value for the public (opportunity costs)

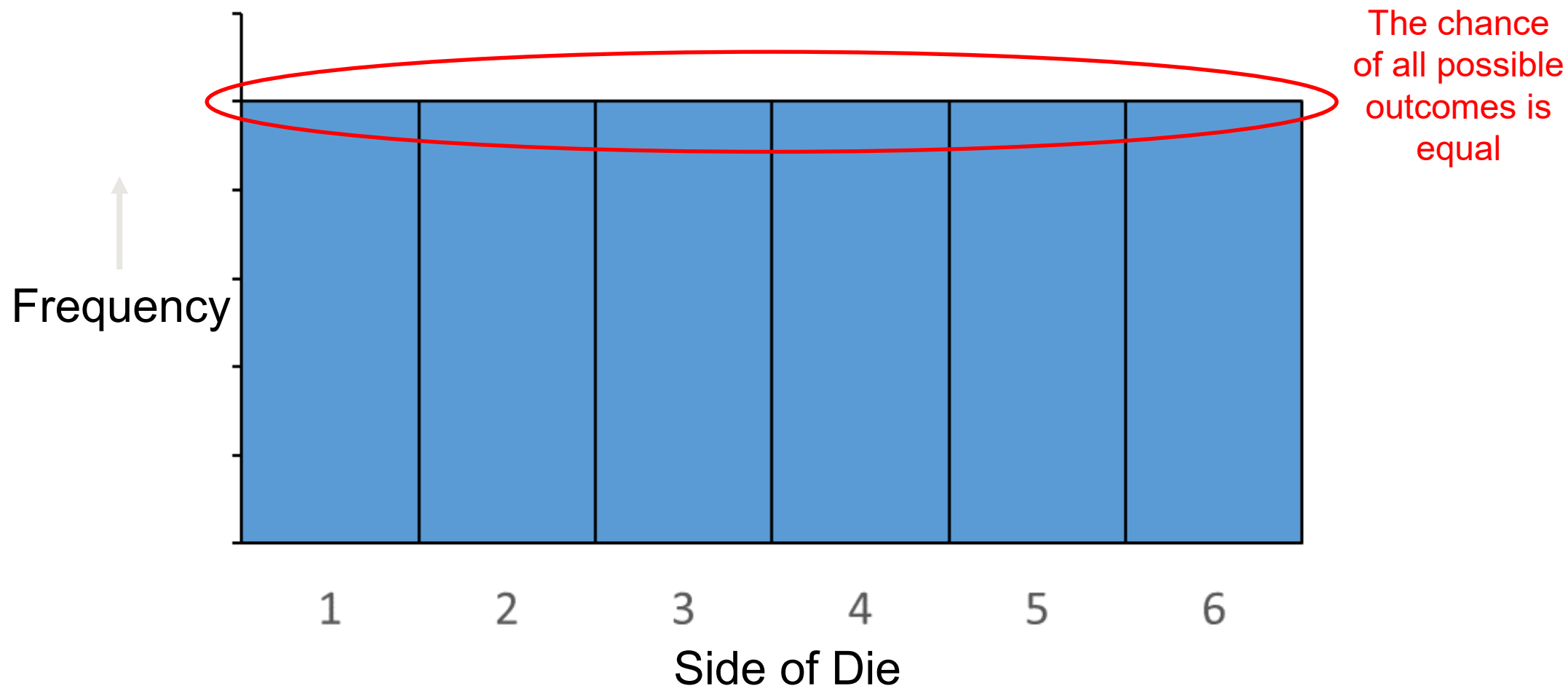
A risk analysis should help you find the “goldilocks” amount of reserves

Tool 2

Uncertain Numbers are Shapes

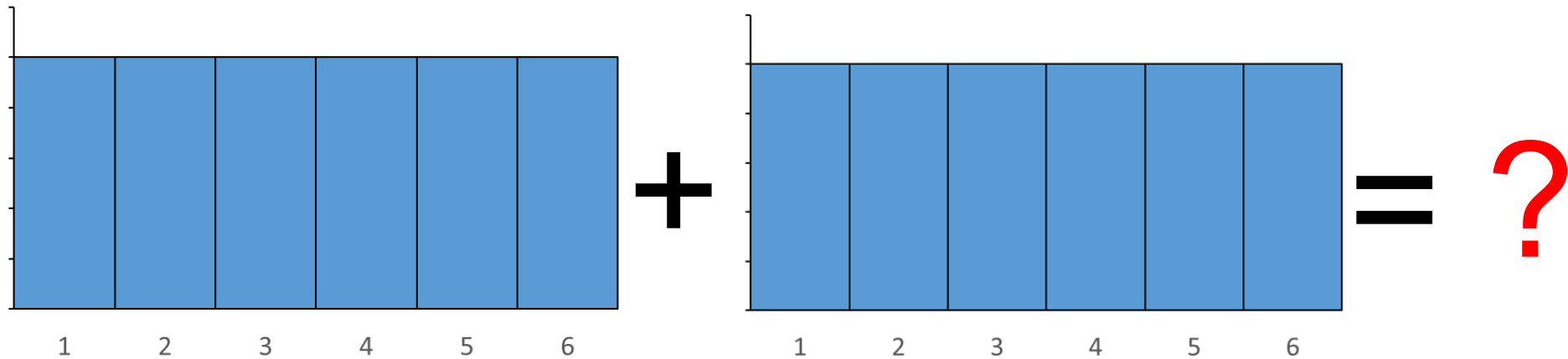
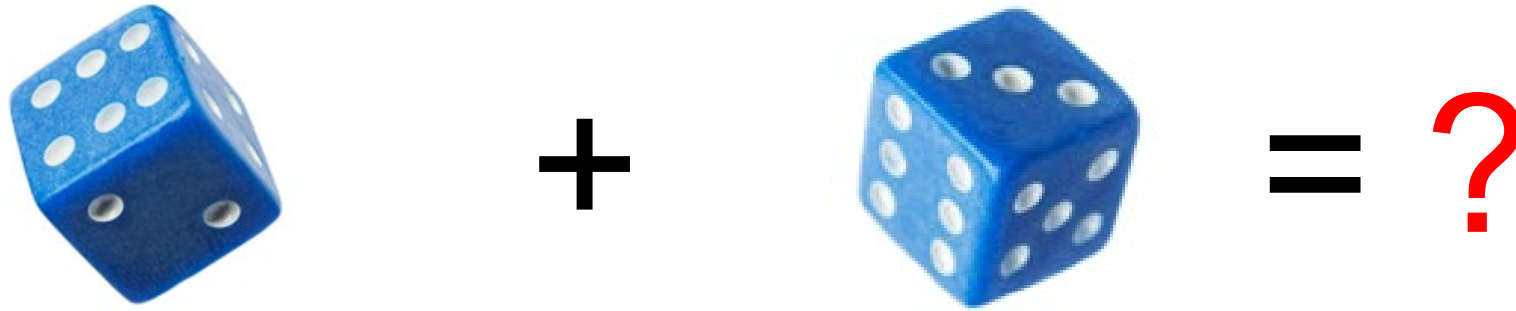


Single Die Histogram*



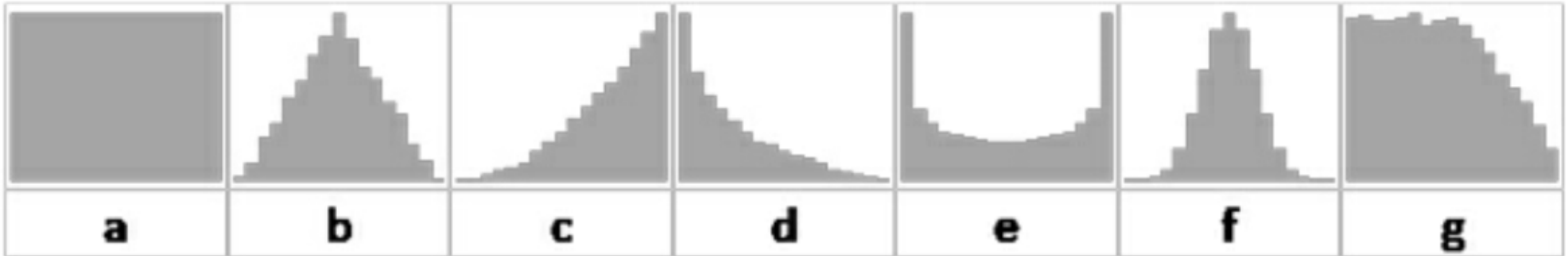
This shape is relatively rare in the uncertainties we are concerned with. Let's see those shapes and where they come from

What about Two Dice?*

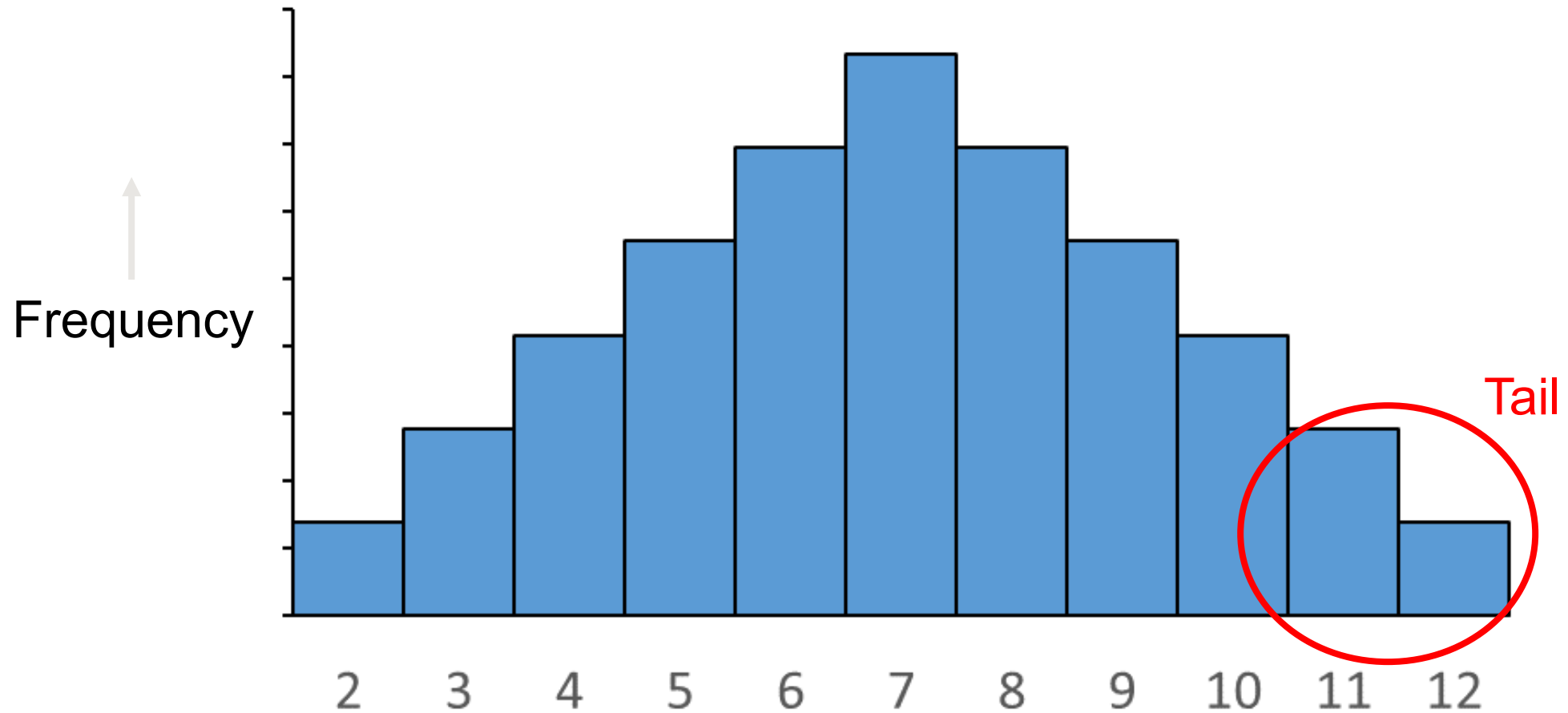


*Dice example provided courtesy of Sam Savage author of *The Flaw of Averages*.

What's Your Choice?

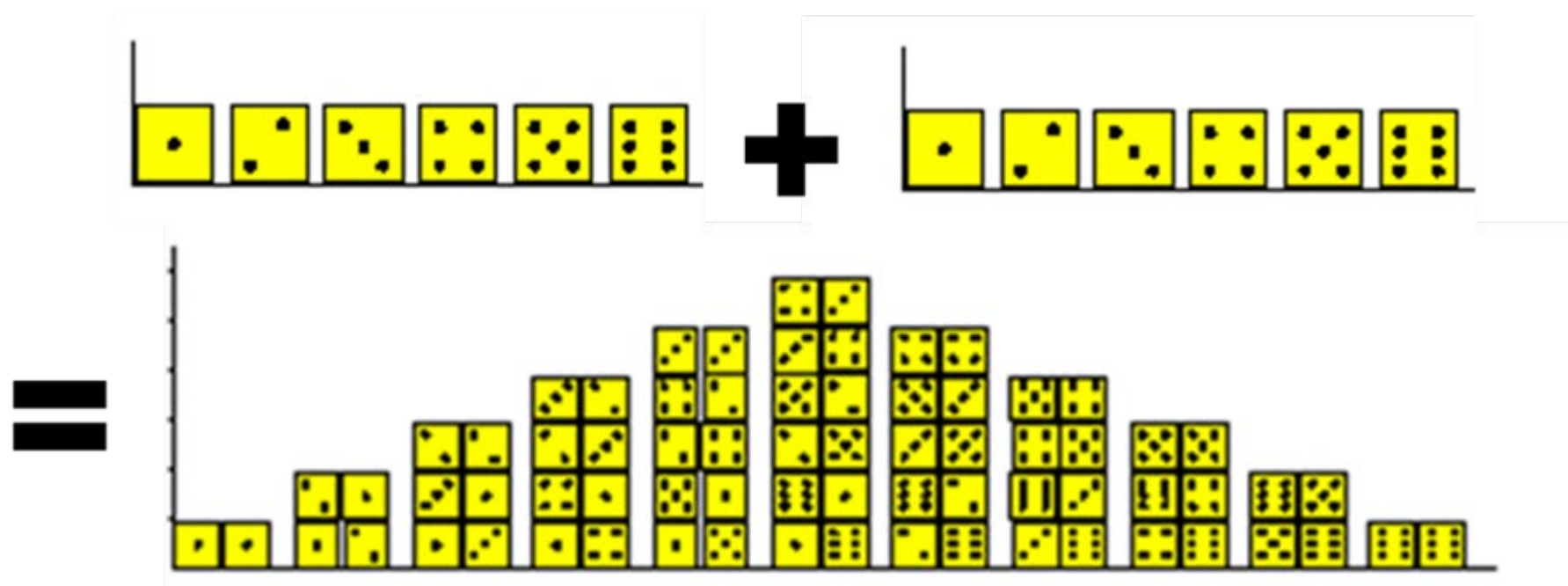


The Surprising Answer*...



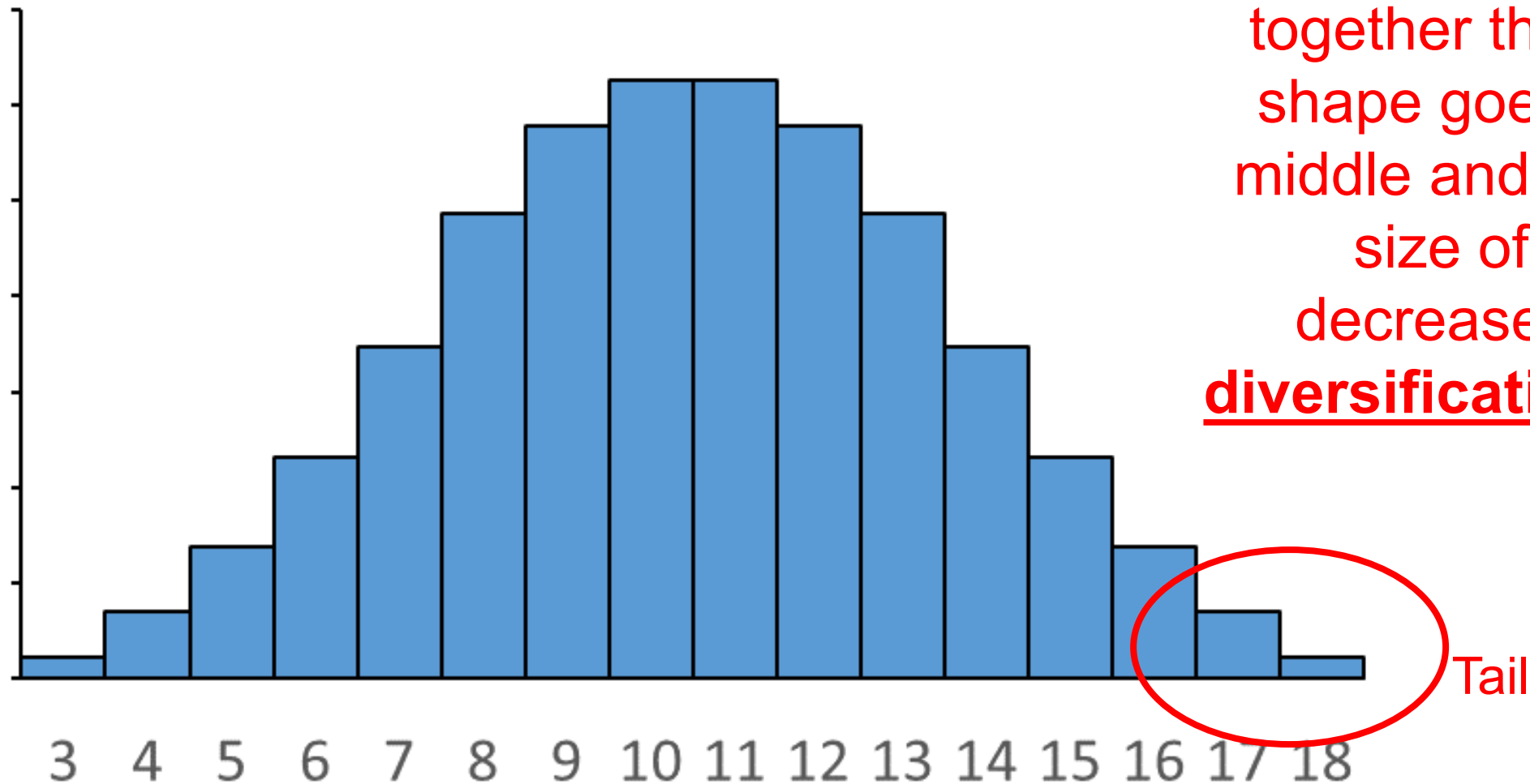
*Dice example provided courtesy of Sam Savage author of *The Flaw of Averages*.

A Visual Explanation*



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

What about Three Dice?



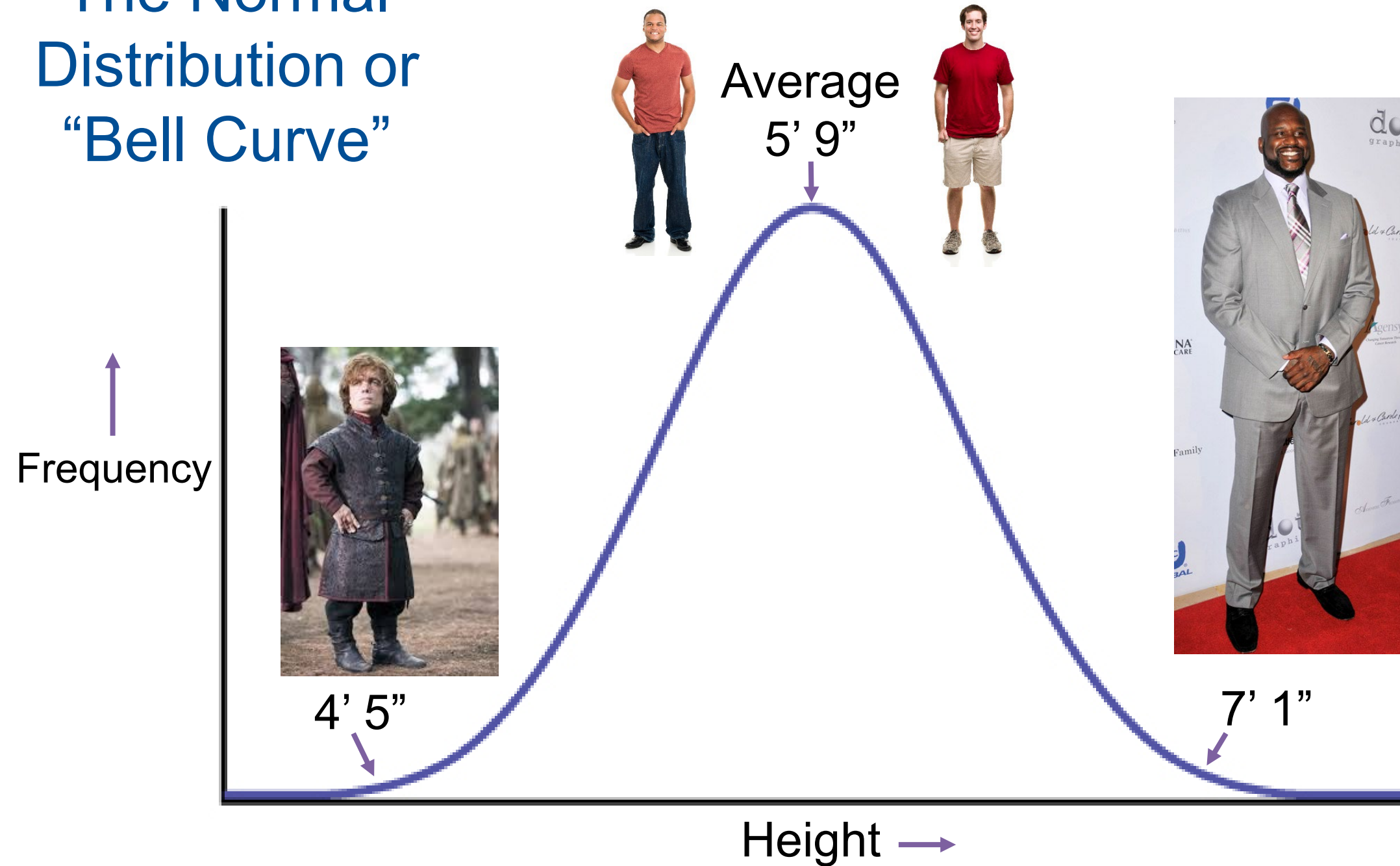
The more shapes (uncertainties) you add together the more the shape goes up in the middle and the relative size of the tail decreases. This is **diversification** in action.



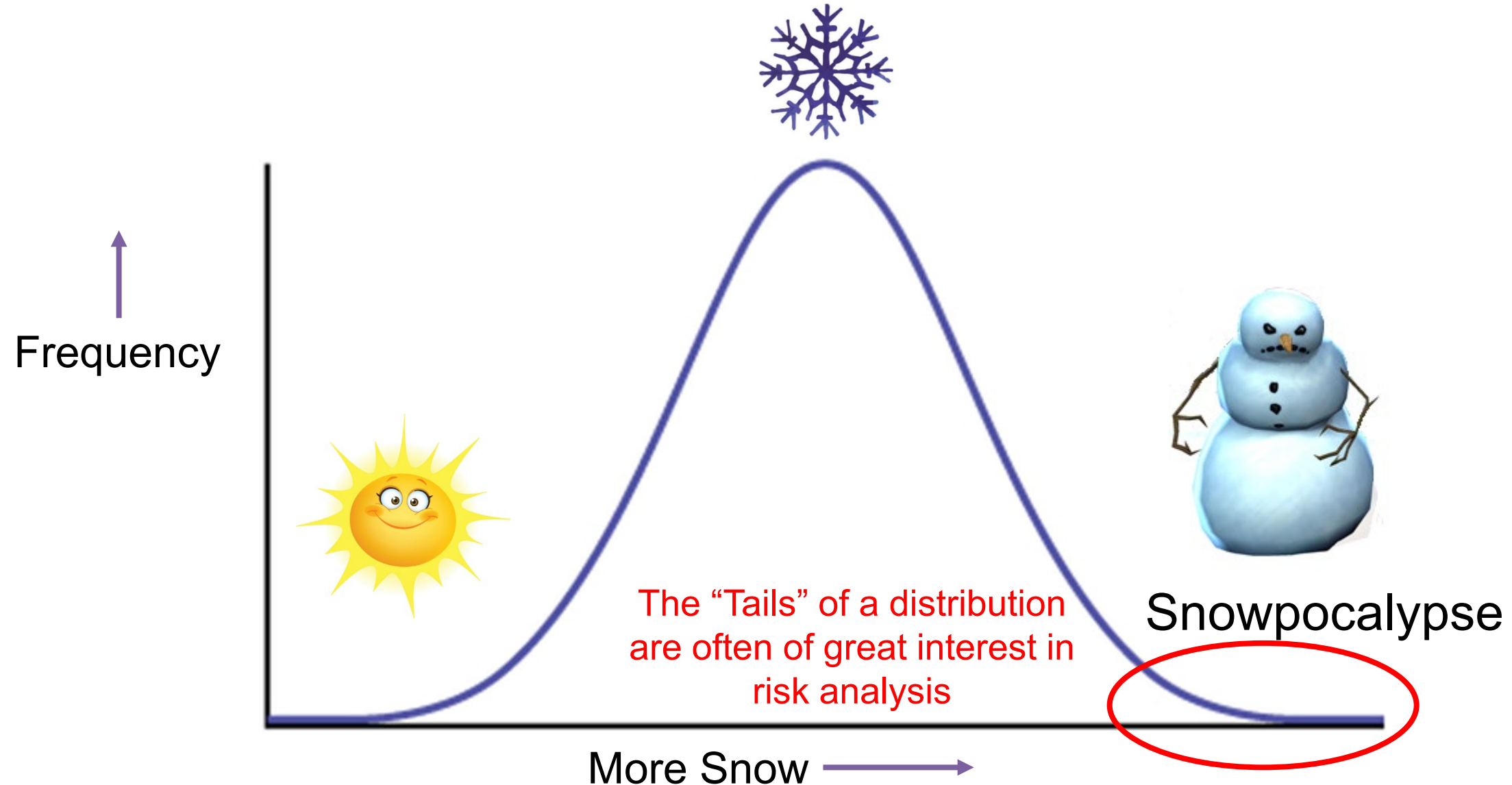
Tool 3

Combination of Uncertain Numbers

The Normal Distribution or “Bell Curve”



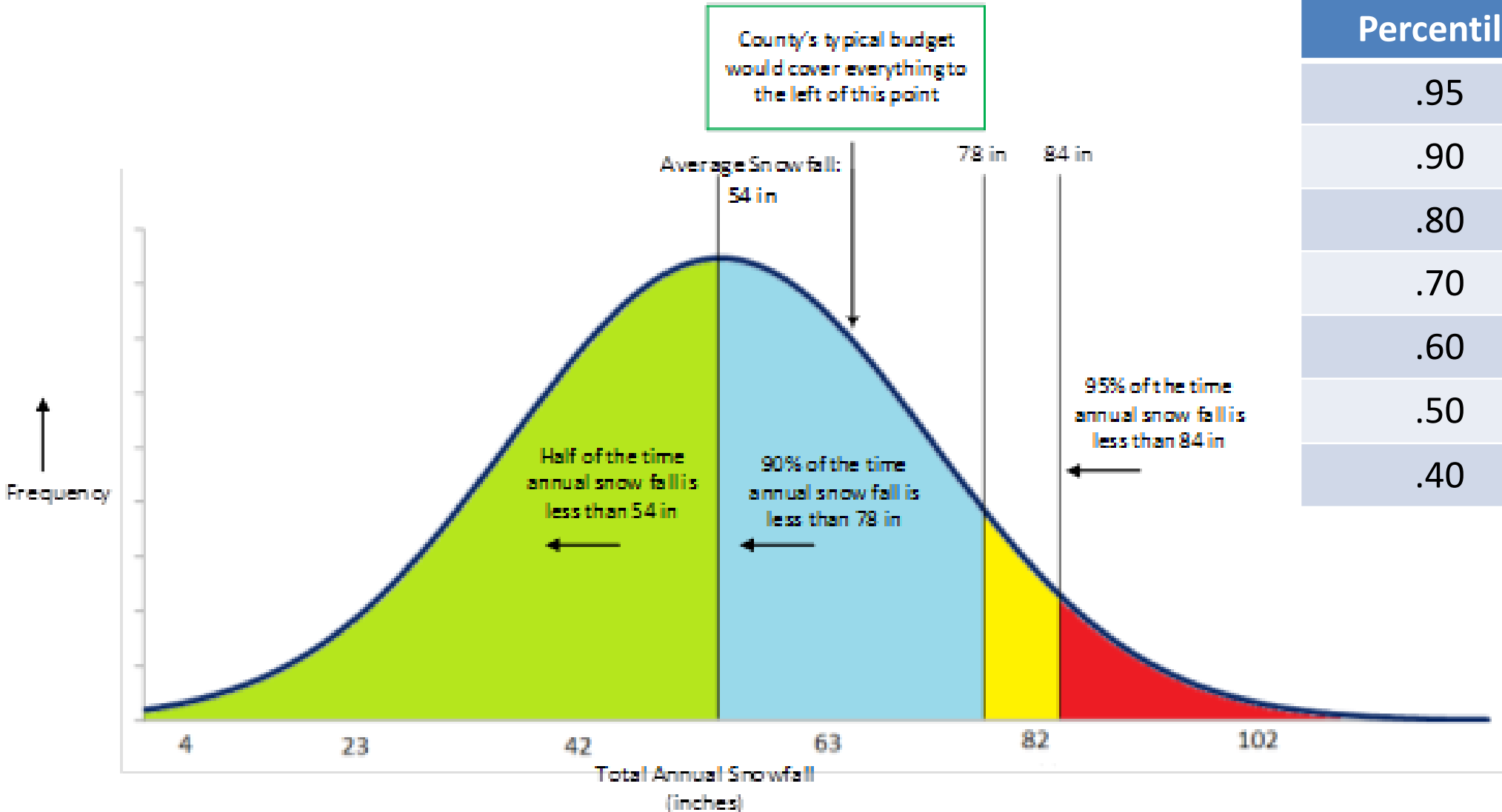
Normal (Symmetrical) Distribution in Local Govt





Normal Distribution Applied to a County

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



Tool 4

Interrelated Uncertain Numbers

Let's Go from...

Dice...



...to Dominoes



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



Case Example: Yountville



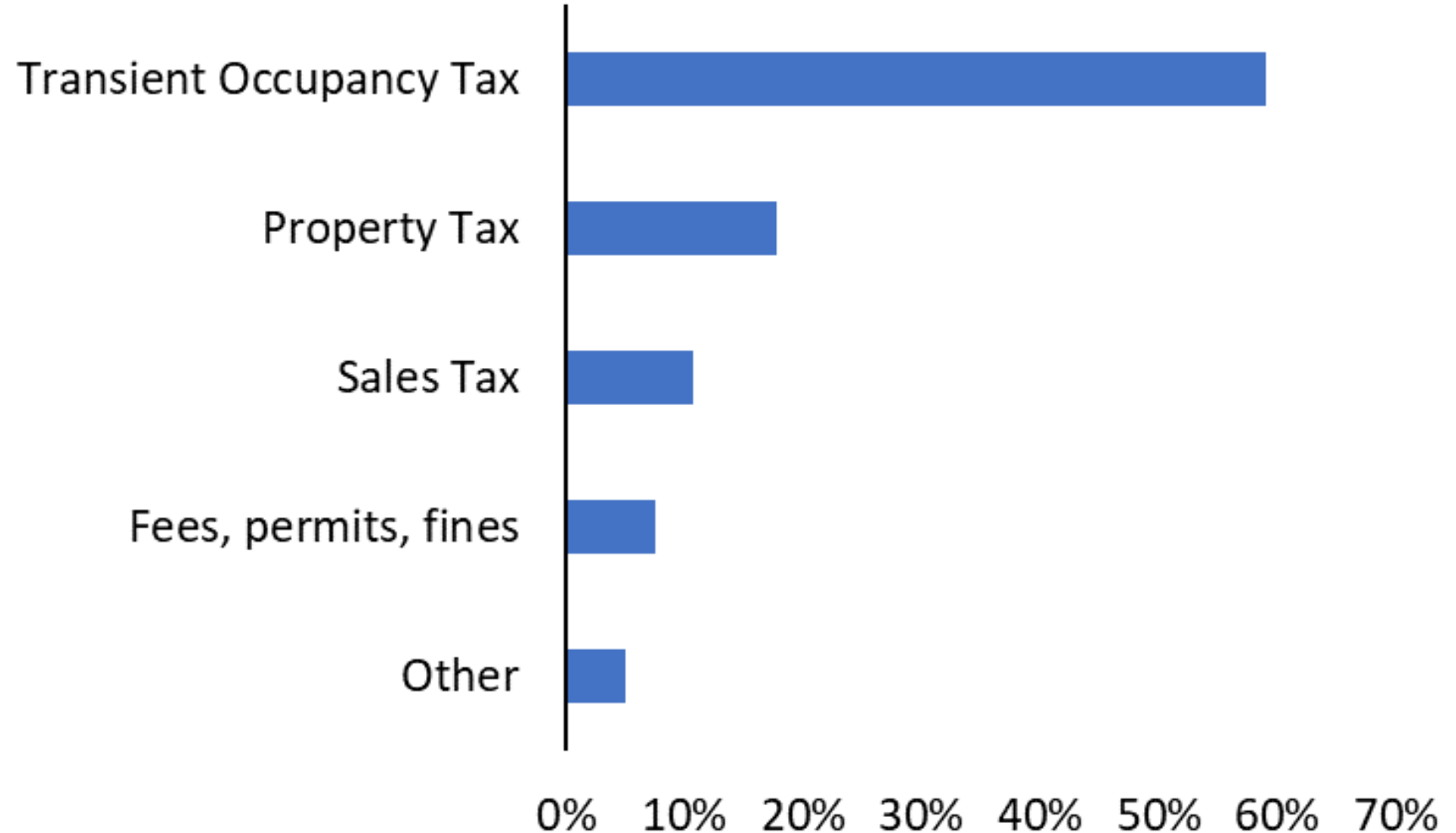
Natural Catastrophes

- Earthquakes
- Wildfires
- Floods

		IMPACT						
		Minor	Limited	Critical	Catastrophic			
PROBABILITY	Highly Likely	Medium	High	 WILDFIRE	Extreme			
	Likely	 LANDSLIDE	 SEA LEVEL RISE	 FLOOD	 DROUGHT	 CLIMATE CHANGE	High	 EARTHQUAKE
	Possible	 LEEVE FAILURE	 SEVERE WEATHER	 HIGH HEAT	High	High		
	Unlikely	 TSUNAMI	 HIGH WIND	 VOLCANO	Medium	 DAM FAILURE		

Revenue Instability

- Recessions
- Interruptions to TOT

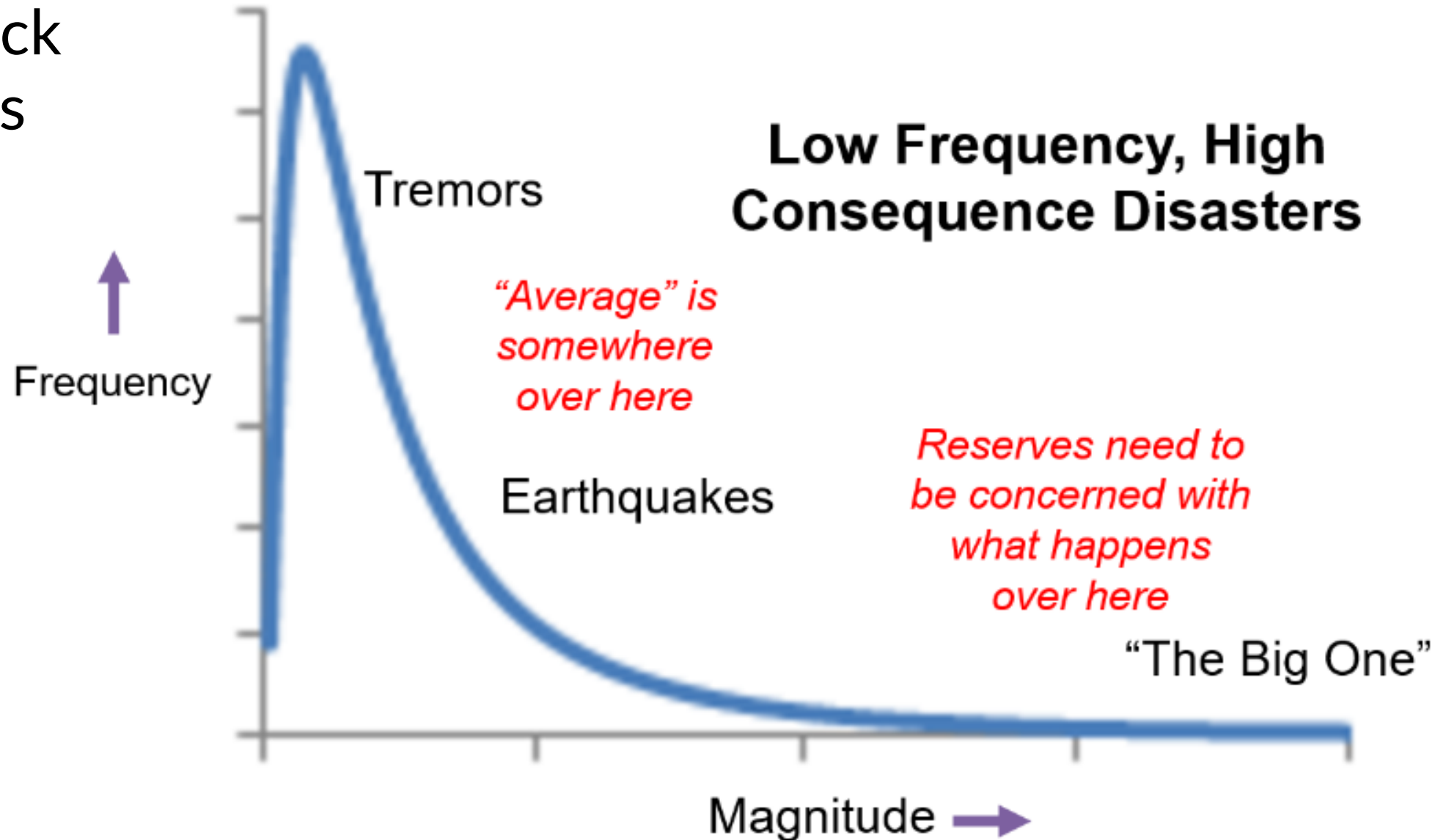


How Did We Analyze Exposure to Natural Catastrophe?

- Examine losses to California local governments from these kinds of extreme events since 1999
- Scale damages to Yountville population and for inflation
- Consider other contextual adjustments, such as...
 - Town's small size
 - No earthquake above 6.8 magnitude since 1999
 - Rector dam risk

Important Feature of Natural Catastrophes

Hockey stick
shaped loss
curve



High Impact Versus Low Impact

For each risk we identified a possible high and low impact...

Natural Catastrophe	Low Impact	High Impact	Notes
Earthquake	\$380,000	\$1.8 million	• Low impact represents 10% of loss cases being larger than this number, for a 6.0 to 6.8 quake. • High impact represents Yountville's prior actual loss scaled up to a quake above 6.8 magnitude.
Wildfire	\$215,000	\$412,000	• Low impact represents 10% of loss cases being higher than this number. • High impact represents 5% of loss cases being higher than this number. • Town's small size suggests vulnerability to larger losses



The total is about \$3.7 million (low) and \$9.3 million (high)

Our Starting Points

- GFOA can't tell the Town the exact optimal amount because a policy must incorporate the Town officials' *risk appetite*.
- Regardless, the Town should pick a range of acceptable reserves, rather than a single number
 - Accommodates diverse risk appetites
 - Provides for clear course of action if reserves are off target

Other Factors to Consider...

Issue	Implication for Risk Aversion	Notes
FEMA/CalOES	↔	Does not reduce need to hold reserves, but helps replenish faster
Simultaneous Risk Events	↓	Unlikely that all or most risks will happen at once.
Analysis uses Historical Data	↑	Historical data does not account for climate risk
Unknown Unknowns	↑	Risk analysis does not include risks we don't and can't know about
Small Town	↑	As small municipality, the Town is less geographically diversified, which could make the Town more vulnerable to a large loss.
TOT Dependency	↑	The Town is highly dependent on TOT and TOT risk is linked to many of the other risks that the Town is subject to.
Spending cuts	↓	The Town can reduce costs in response to a revenue loss or even in response to an expenditure spike. Cuts of 3.5% to 4.5% appear reasonable for planning purposes.
Commercial Insurance	↓	Insurance might provide coverage that substitutes for reserves
Opportunity Costs	?	What are alternative uses of the funds and how do those benefits compare to insuring against the risks described in this report?



Case Example: Salt Lake City



Natural & Human-made Catastrophes



Wildfires



Earthquakes



*Tornados &
Strong Winds*



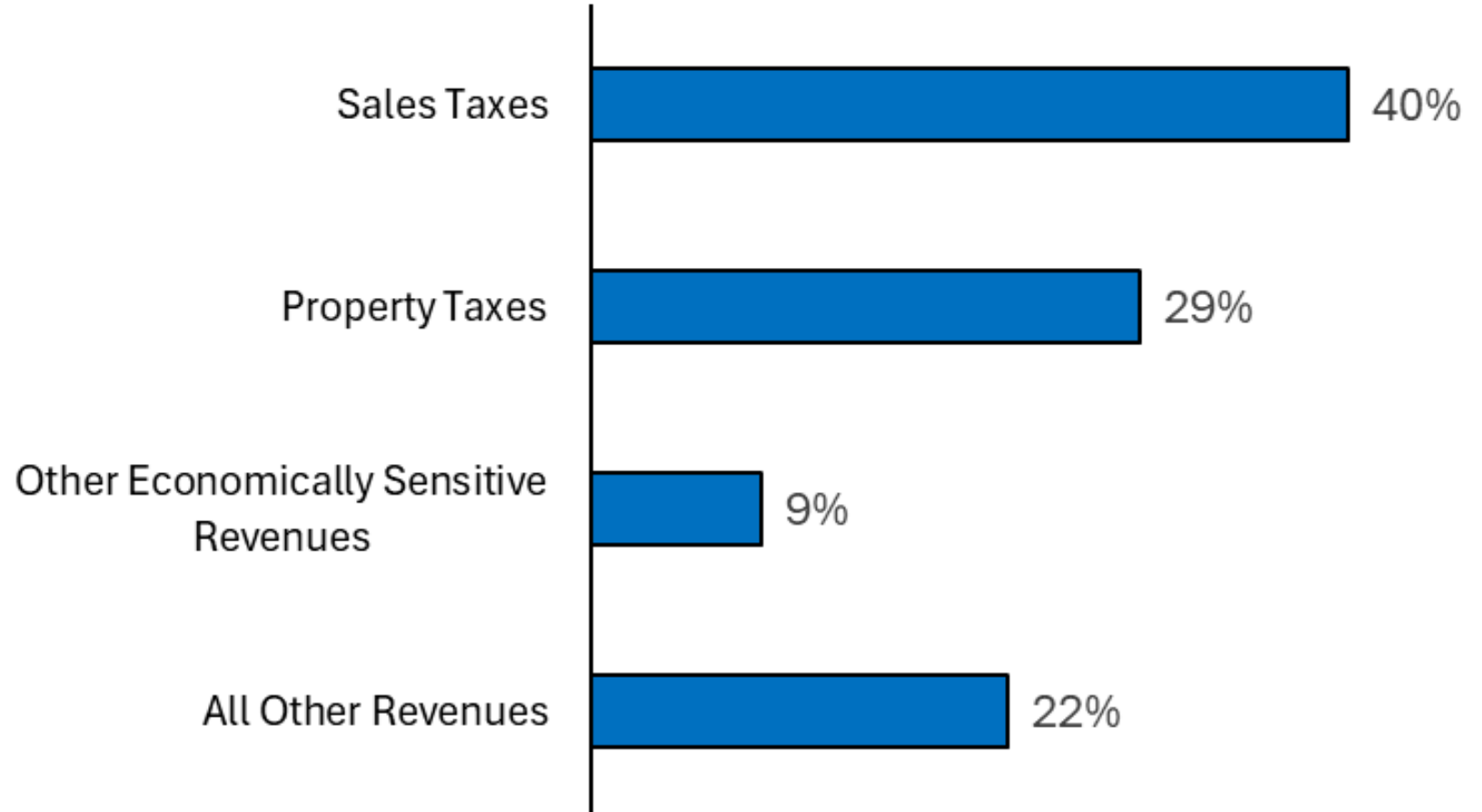
Other Hazards



Floods



Revenue Instability (Recessions and Pension)



How Did We Analyze Exposure to These Risks?

- Monte Carlo computer simulation
 - Has been around since the 1950s
 - Standard practice in industries like insurance
 - Basically, we built a multiverse of Salt Lake City



Where the Data Came From

- SLC's own historical experience
- Historical experience in the wider region.
- SLC finance and public safety staff
 - Calibrated estimators
- Third party experts
 - Aon and FirstStreet.org
 - State earthquake experts
 - County flood experts



Break for Excel



Conclusion

Resources and Questions

- Visit gfoa.org/risk-analysis for the resources described here and much more

Check out: *Should We Rethink Reserves? A Multimillion-Dollar Question*

