

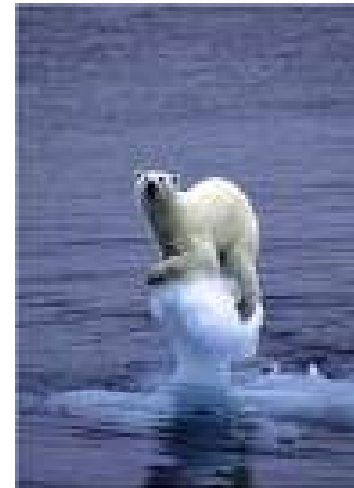
The Challenges of Extreme Events and Systemic Risks

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Extreme Events



The Nature of Extreme Events

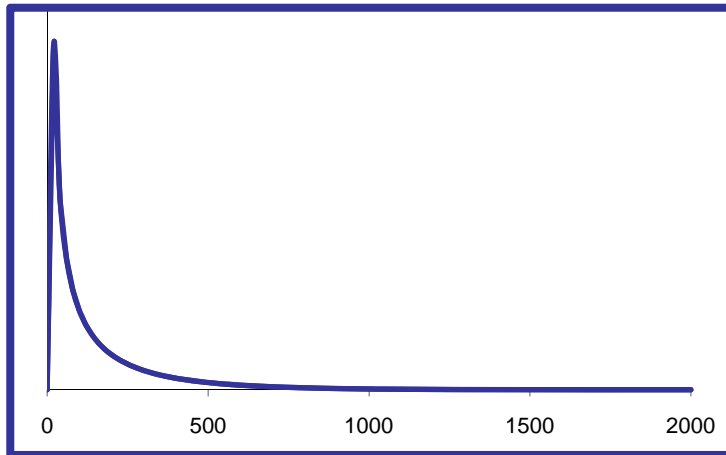
- Unknowable events or consequences
- Extreme tails of the distribution
- Dynamic ripple effects
- Game changer

Examples

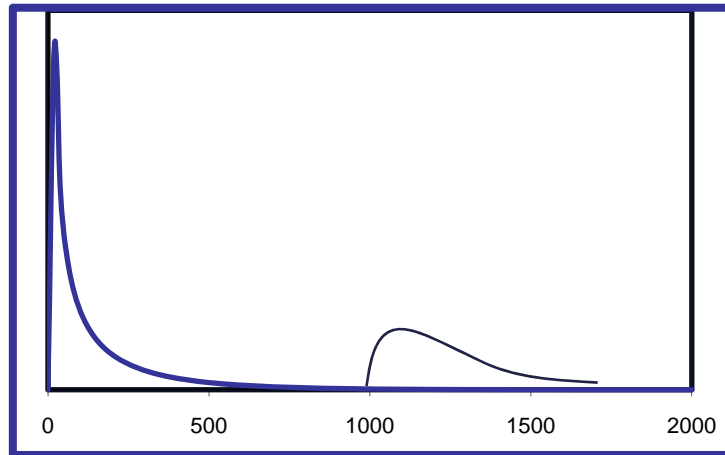
- Hurricanes and Earthquakes:
 - ❖ Knowable events and consequences
- Terrorism:
 - ❖ Unknowable events, knowable consequences
- Systemic financial risks:
 - ❖ Knowable events, unknowable consequences
- Climate Change
 - ❖ Unknowable events and consequences?



Extreme Tails of the Distribution



Probability distribution
without aggravating
events

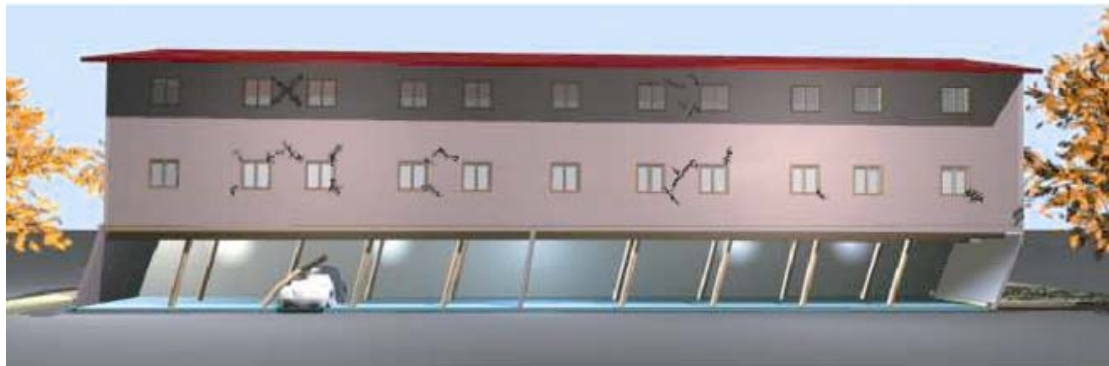


Probability distribution with
aggravating events

Katrina Overtopping vs. Levee Breach



Tuckunder Apartment Retrofits

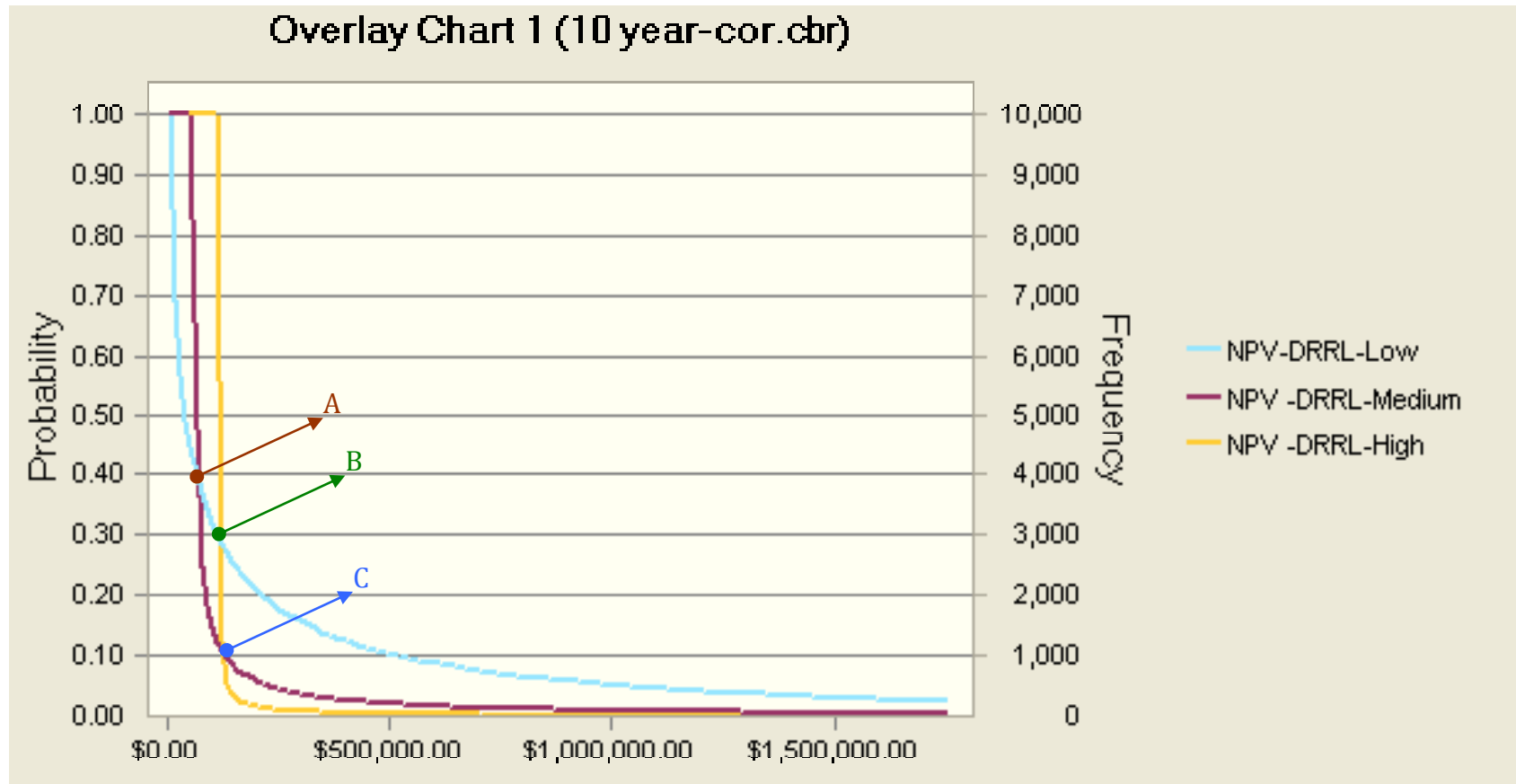


Distribution of
Emergency
City Tagging

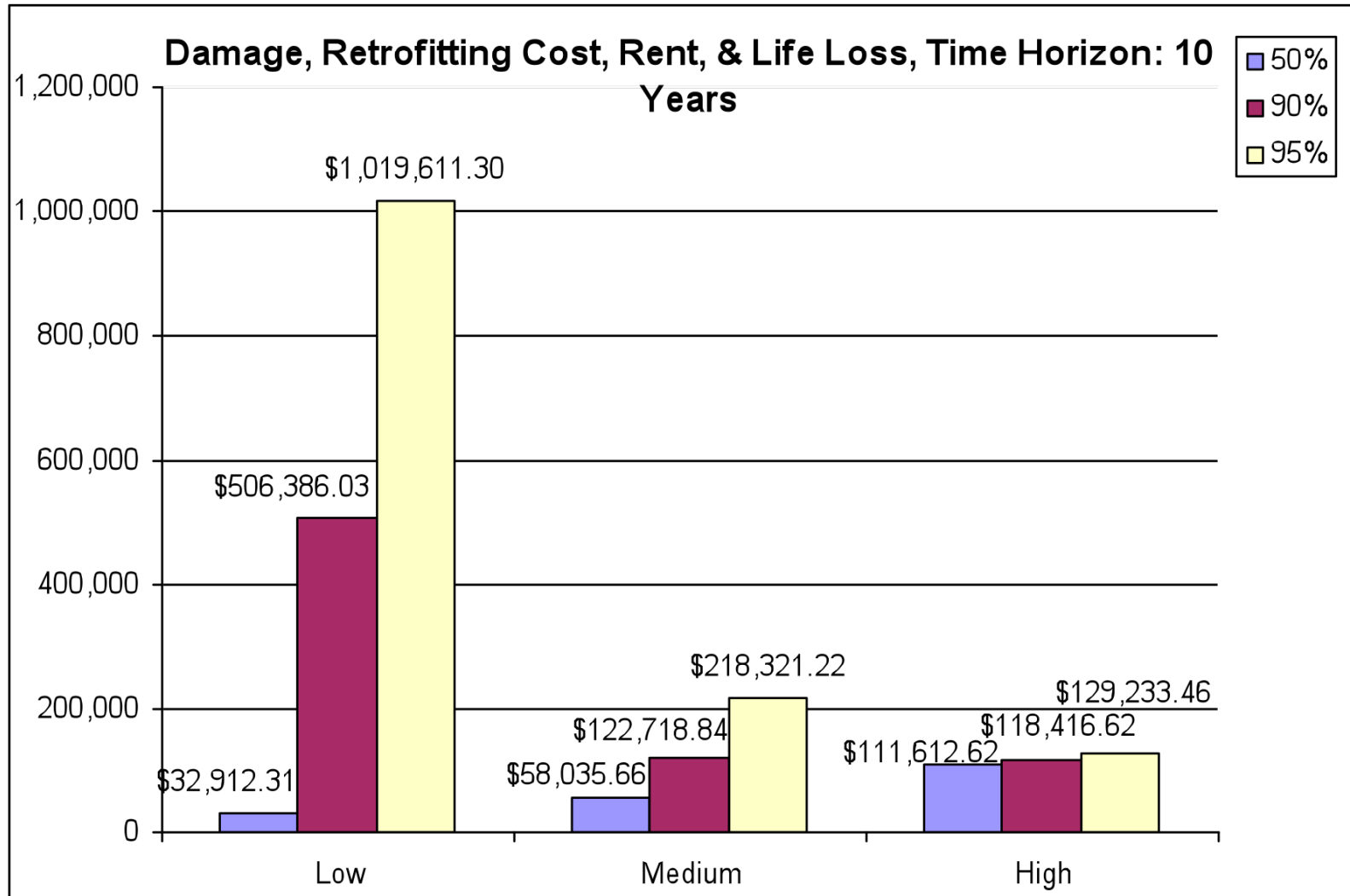


Distribution of
Displacement
of Occupants

The Tail of Exceedance Distributions



Making Decisions Based on the Tail

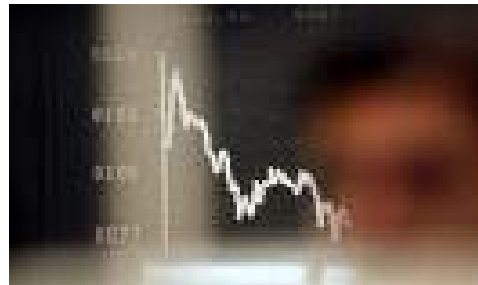


Examples of Dynamic Ripple Effects

Terrorism



Economic Crisis



Indirect Economic Impacts of Disasters

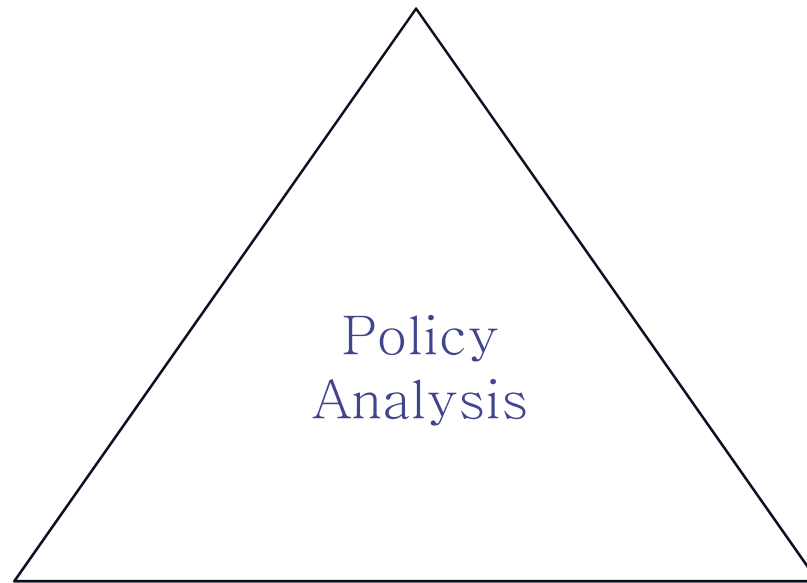
Event	GDP Loss	Cause		
Northridge Earthquake	25 billion	Business Interruption		
Hurricane Rita	30 billion	Business Interruption		
World Trade Center Attack	100 billion	Reduced air travel for two years		
Missile attack on Planes	250 billion	Reduced air travel for two years		
Rad Attack on Harbor	320 billion	Harbor shutdown for one year		
Border Shutdown (US)	2,400 billion	No goods or people movements		

Game Changers

- Terrorist Attack on the World Trade Center in 2001
 - ❖ Changed the way we look at national security
- Tsunami in Indonesia in 2003
 - ❖ Changed the way we look at risks in developing countries
- Economic Crisis of 2008/9
 - ❖ Changed the way we look at interconnected risks

What Kind of Research is Needed?

Risk Assessment



Dynamic Systems Analysis Behavioral Research

Thank You

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