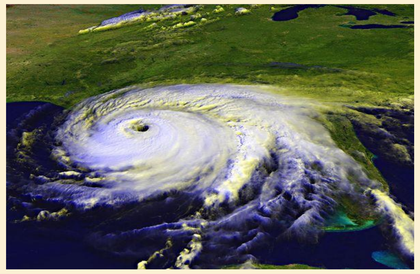
# Allocating Resources for Prevention, Preparedness, and Response: an application to an oil spill and hurricane

Amro Al Kazimi – Senior – Kazimi@iastate.edu
Cameron MacKenzie – Assistant Professor – Camacken@iastate.edu
*Iowa State University - Department of Industrial and Manufacturing Systems Engineering*

## Disasters on the Rise

- Costs from disasters have risen from $50 billion to $200 billion in the last decade
- From 2011 – 2013, the U.S. federal government spent approximately $136 billion in disaster relief
- The Gulf of Mexico has been especially vulnerable to significant disruptions such as Hurricane Katrina (2005) and the Deepwater Horizon oil spill (2010)



## Estimating Economic Consequences of Disruptions

- Economic models (Input-Output Models) describe
  - How industries are connected
  - How industries behave during disruptions
- Example: an automobile production facility that is disabled by a hurricane will order fewer tires and less steel

## This Research

- Demonstrates the effectiveness of preparedness activities in reducing the losses of the disaster
- Uses the Input-Output model to optimize how much, if any, to spend on preparing for each disruption

Objective: Minimize economic losses

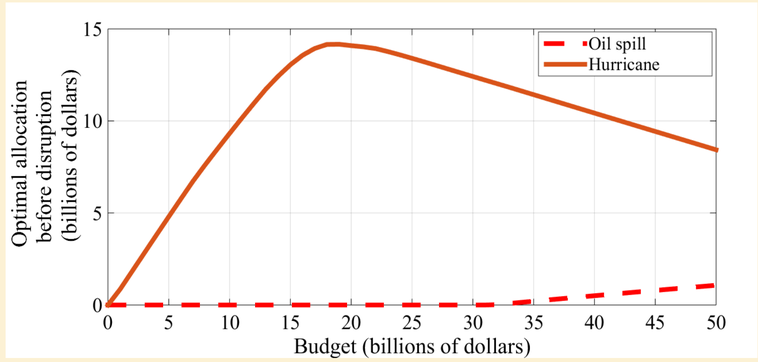
Decisions: (1) How much to spend to prepare for either a hurricane or oil spill and (2) how much to spend to recover after disaster

Constraint: Money spent must not exceed budget

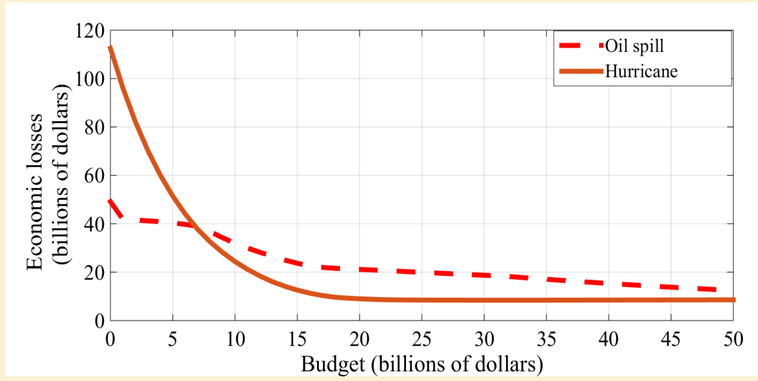
## What We Did

- Identified the impacted industries from Hurricane Katrina and Deepwater Horizon oil spill
- Calculated losses for each of the impacted industries
- Calculated the effectiveness parameter for each industry (if $X amount of dollars were spent to prepare, losses would have been $Y instead of $Z
- Inputted parameters into optimization model with Input-Output economic model

## *Optimal allocation to spend prior to a disruption*




## Production losses for each disruption given optimal allocation from a budget




## Conclusion

- Should spend most of the budget preparing for a hurricane because it is more likely and more costly than an oil spill
- Optimally allocating resources can save hundreds of billions in economic losses
- Diminishing marginal benefits of allocating funds to prepare for each disaster