Interdependent Effects of Supply Chain Disruptions and Mitigation Strategies: Case Study of the Japanese Earthquake and Tsunami

1. Research Goals

Part I
- Develop simulation model to assess supply shortages caused by disabled production facilities
- Apply simulation to automobile sector disruption caused by Japanese tsunami

Part II
- Calculate international production losses from tsunami based on data from Japanese government

2. Part I: Automobile Sector Disruption

Japanese earthquake and tsunami caused supply chain disruptions in automobile sector

Production facilities of automobile suppliers disabled
Production facilities of Japanese automakers disabled
Supply shortages and reduced production for both Japanese and non-Japanese automakers

3. Simulation of Automobile Disruption

- Simulation flow chart for each period that supplier’s facility is disabled
- Simulation continues until all facilities are reopened

4. Simulation Parameters and Results

Simulation results: Average production during disruption

5. Part II: Macroeconomic Model

Calculates international production losses based on macroeconomic data from the Japanese government
Measures losses due to changes in demand from Japanese industries and consumers (input-output model)
Does not capture supply shortages

6. Macroeconomic Results

Japanese production changes categorized across industries (March – May 2011)

7. Conclusions

Macroeconomic model
- Without inventory, production losses in Japan total $93 billion (3.2% of Japan’s normal production)
- With inventory, production losses in Japan total $63 billion
- Production losses in other countries due to decreases in demand are relatively small ($13 billion)

Automobile sector disruption
- Simulation of disabled automobile production facilities after Japanese earthquake and tsunami reflects supply shortages
- Mitigation strategies include moving production to alternate facilities, maintaining inventory, and buying from alternate suppliers
- Mitigation strategies enable almost all of customer demand to be met

Future work
- Upcoming submission decision making strategies for managing disruptions

References: