Modeling Demand Surge

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Bringing Science to the Art of Underwriting™
Insurance and Catastrophe Risk

- Insurance is founded on the principle of risk diversification
- Key challenge to the insurance industry is risk correlation
  - Insurers buy insurance from reinsurers to protect themselves against Catastrophic (CAT) losses
  - Reinsurers often find it difficult to diversify their own ‘Super-CAT’ losses beyond the insurance industry
Loss Amplification

‘Loss amplification’ reflects all those ways in which the costs incurred for a certain level of original damage become amplified when the damage is situated within a major catastrophe.

- The components of loss amplification
- Historical reconstruction pricing analysis following 2004 and 2005 U.S. hurricane seasons
- Modeling economic demand surge
- Summary
Recent Experience of Loss Amplification

- **1992 Hurricane Andrew**
  - Significant increases in costs of labor, materials, underinsurance – estimated at 20%

- **1994 Northridge Earthquake**
  - Major loss amplification effects from shortage of builders and expansion of coverage terms – estimated at 40%

- **1999 Windstorms Lothar and Martin (France)**
  - Government intervention after widespread power outages forced insurers to reduce deductibles and apply ‘no claims assessor thresholds’ – insurers proceeded to ‘outbid’ each other

- **2001 WTC Attacks**
  - Contamination and evacuation sources of loss amplification, as well as systemic economic impacts (seen in contingent BI)

- **2004 Hurricanes**
  - Four hurricanes superimposed onto a tight building economy caused significant demand surge - measurable for individual building components and labour costs (concept of ‘accumulation’)

- **2005 Hurricanes**
  - Major loss amplification adds to impacts from 2004 (concept of ‘residual’)

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The Core Components of Loss Amplification

- **Economic Demand Surge**
  - Inflation in costs as a result of the excess of demand over supply in the market for both labor and materials

- **Repair Cost Delay Inflation**
  - Time dependent damage escalation caused by delays in making repairs

- **Claims Inflation**
  - Relaxation of insurers procedures for policing claims to resist exaggeration and fraud

- **Coverage Expansion**
  - Expansion of insurance terms and coverages often as a result of political pressure
Economic Demand Surge

Within insurance context: “A temporary increase in repair costs above the standard level of costs”

Causes:

- Direct:
  - Sudden increase in demand for construction materials and labor force beyond the capacity of the local market

- Indirect:
  - When labor force reduced due to evacuation
  - When local construction sector impaired by damage to facilities
  - When infrastructure damage disrupts access and transport

- Exogenous:
  - Reflects available ‘capacity’ of the construction sector before the event
  - Global pressures on material prices prior to the event
Definition of Demand Surge - One Event

- Comparing pricing before and after a CAT event
- Remove underlying growth trends outside demand surge period
Definition of Demand Surge - Over 2 Seasons

- Economic demand surge is based on the assumption that the valuation has been performed for the year of the event accounting for the long-term growth trend and legacy in the regional economy from previous CAT events or other economic factors.
Historical Demand Surge Quantification

- Reconstruct actual industry losses at county level
- Use detailed claims data and cost estimates after 2004 and 2005 hurricane seasons for reconstructing price changes and estimating demand surges
- Gather other economic indicators for assessing the rate of reconstruction
  - Building permits,
  - Monthly employment,
  - Etc.
Florida Hurricane Insured Losses
Historical Reconstruction of Repair Pricing Changes

- Sample claims that are representative of losses observed in Florida during the 2004 and 2005 hurricane seasons
  - Range of paid losses
  - Range of loss ratios
  - Building characteristics

- Estimate repair cost for the sample using one of the cost estimator tools used by claim adjusters at given time periods
  - Before and after the event
  - Several locations

- Calculate the price change over time

- Calculate economic demand surge at several locations within Florida
Reconstruction of Temporal and Spatial Changes in Costs of Repairs

Cumulative Normalized Price

Daytona Beach
Fort Myers
Fort Pierce
Pensacola
Orlando
Sarasota
Sebring
Jacksonville
Miami
Gainesville
Tampa
Tallahassee
Panama City
FL Augre. Cutoff

Jan-04 Apr-04 Aug-04 Dec-04 Apr-05 Aug-05 Dec-05 Apr-06 Aug-06 Dec-06

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Florida - Quarterly Price Growths

- Quarters without a catastrophe saw prices increase at normal rates and provide baseline growth rates for prices outside of catastrophic conditions.

- “Catastrophe” quarters in 2004 were October 2004 and January 2005.

- “Catastrophe” quarters in 2005 were October 2005 and January 2006.
Reconstruction of Temporal and Spatial Changes in Costs of Repairs due to Economic Demand Surge
Modeling Economic Demand Surge - Main Drivers for Construction Sector

- Overall economic demand surge pressure is a function of the total work time involved in restoring all the damage from the catastrophe.
- Threshold for demand surge is determined by the capacity in the repair sector prior to the catastrophe.
- As costs of labour rise, workers are drawn in from outside the region.
- Eventually prices tend to plateau as additional costs of travel and accommodation are built in to the rates charged by out of region workers.
- Any limitation on workers arriving from out of region will allow demand surge to continue to increase.
Model Principles

- **Market clearing in the construction sector**

  Price \((p)\) is such that demand \((D+L)\) equals capacity \((C)\) in each county \(i\)

  \[
  (D_i+L_i) \cdot f(p_j) = C_i
  \]

- **Incentive to work in the construction sector**

  \(C_i\) increases when \(p_i\) increases as more workers shift toward the construction sector

- **Incentive to move to the most affected countries**

  If \(p_j > (p_i + d_{ij} \cdot c_{ij})\), then workers move from county \(i\) to county \(j\)
Price Changes

All Florida using weights on Loss and exposure

Cumulative prices normalized to Jan 2004

Orlando

Miami

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Price Growth Changes

Growth calculated from Historical Price Reconstruction

Growth calculated from the model
Sample Results - Price Changes after removing inflation and normalized to January 2004
Summary

- Impact of economic demand surge can be ‘non negligible’
- Detailed data from 2004 and 2005 U.S. hurricane seasons are used for testing economic modeling of demand surge
- A simple economic model focusing on the construction sector is developed (as presented here)

Next Steps:
- Investigate impacts of initial economic conditions
- Applications to other regions
- Integration within a probabilistic loss assessment model
- Develop a model that accounts for all sectors