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Informed Decisions on Catastrophe Risk

Quantifying the Role of Effective and Well-Enforced Building Codes in Reducing Natural Disaster Property Losses:

The Case of Hail Storms in Missouri

In order to reduce losses from natural disasters, effective building codes must be properly enforced.

- Having strong building codes in place in a community is frequently touted as a critical component to reducing total property damage due to natural disaster occurrence.
- However, many states in the U.S. have no statewide building code in place; adoption is left up to individual municipalities. Even if localities adopt similar building code standards, it is unlikely all jurisdictions would equally and/or properly enforce their codes once they have been adopted.

Hail storms are a persistent and chronic source of property losses for homeowners and insurance companies in the United States.

- U.S. property insurer losses due to hail storms are conservatively estimated at $1.6 billion per year. In recent years, the trend in severe weather damage has increased significantly. In 2011, the insurance industry experienced its worst wind/tornado/hail year ever, at over $26 billion in claims.
- 44 percent of the country is at "average risk" (2-3 hailstorms per year on average) or above of being hit by a hailstorm, with 75% of the cities in the continental U.S. experiencing at least one hailstorm per year.

For each of the three years from 2008-2010, impacted ZIP codes in Missouri averaged 4,000 claims per year, with an average loss of approximately $7,500 per claim.

- Hail losses are the second largest cause of insured property loss in Missouri (MO) from 2008 to 2010, as well as the most frequent source of a loss claim incurred.
- Missouri (MO) is a state where building code adoption and enforcement is at the jurisdictional level.

A midsize community of 50,000 people that experiences a moderate hail storm could expect to reduce losses by approximately $4 to $8 million by adopting and enforcing appropriate building codes.

- Based upon various industry and exposure-based models, the more favorably rated ZIP codes in MO with effective and well-enforced building codes significantly reduce damage from hail from 12% to 28% on average, as compared to less favorably and unclassified rated ZIP codes.
- Highlighting this type of substantial savings is critical for decision makers weighing the costs and benefits of implementing more effective and well-enforced building standards.

ISO's BCEGS ratings provide a joint assessment of both the stringency of adopted codes in addition to how well these adopted codes are enforced.

- Since 1995 the Insurance Services Offices (ISO) has primarily administered the Building Code Effectiveness Grading Schedule (BCEGS®) ratings for the property/ casualty insurance industry across the entire country. The ratings place special emphasis on the mitigation of natural hazard losses and the role of code enforcement.
- We utilize the BCEGS ratings in MO to examine and quantify the role that effective and well-enforced building codes play in the mitigation of residential property damage from hail.

We model industry and exposure-based hail claims insurance data from 2008 to 2010 in the highly hail impacted state of Missouri.

- The property loss data comes in two forms: 1) Insurance Services Office (ISO) property/casualty insurance industry claim data aggregated at the ZIP code level; and 2) more granular exposure-based data from a national property insurer.
- We utilize data on insured losses from 2008 to 2010 to explain the observed damage while controlling for hazard (e.g., hail size and frequency), exposure, and vulnerability variables (e.g., construction type and roof type) that can either increase or decrease loss, including the BCEGS ratings.
- For our loss models we use a discrete group of BCEGS ratings in the empirical analysis of "more favorable" (average ratings 1 to 4), "less favorable" (average ratings 5 to 10), and unclassified (average rating 99).

Adhering to local building codes, as well as communities' ensuring the proper licensing and enforcement of contractors, plays a critical role in the mitigation of hail losses.

- Proper installation (e.g., only one layer of shingles) and the quality of materials used to construct the roof and supporting structures determine how much damage a structure will sustain if the structure is exposed to hail.
- We also find that it is better to have some minimally effective and enforced code in place as opposed to none at all.

Figure 1 shows the location of each of the 532 unique ZIP codes in MO with a hail loss in at least one of the three years from 2008 to 2010, overlaid with their determined average BCEGS rating. Among the 532 unique ZIP codes with at least one claim, 59 percent have a BCEGS rating – either more favorable (19%), or less favorable (40%). Thus, for our analysis, conditional upon the occurrence of the hazard, only 41 percent of ZIP codes in Missouri used in the loss analysis have an unclassified 99 BCEGS rating. The more heavily populated areas of the state such as Kansas City, St. Louis, Joplin, Springfield, etc., have BCEGS ratings in place.

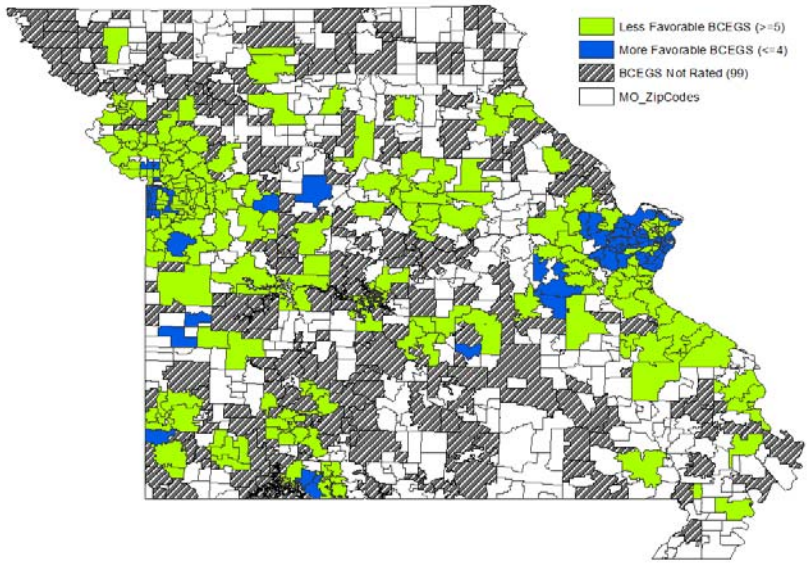

FIGURE 1. 532 UNIQUE ZIP CODES IN MO WITH A HAIL LOSS IN AT LEAST ONE OF THE THREE YEARS FROM 2008 TO 2010, WITH ASSOCIATED BCEGS RATING

We are able to use our industry loss model coefficient point estimates to illustrate expected damages across various levels of our independent variables using the mean value for all independent variables. For example, Figure 2 shows predicted losses from our estimations for various categories of hail size. This figure also illustrates lower average predicted damages for ZIP codes with more favorable BCEGS ratings for all hail sizes.

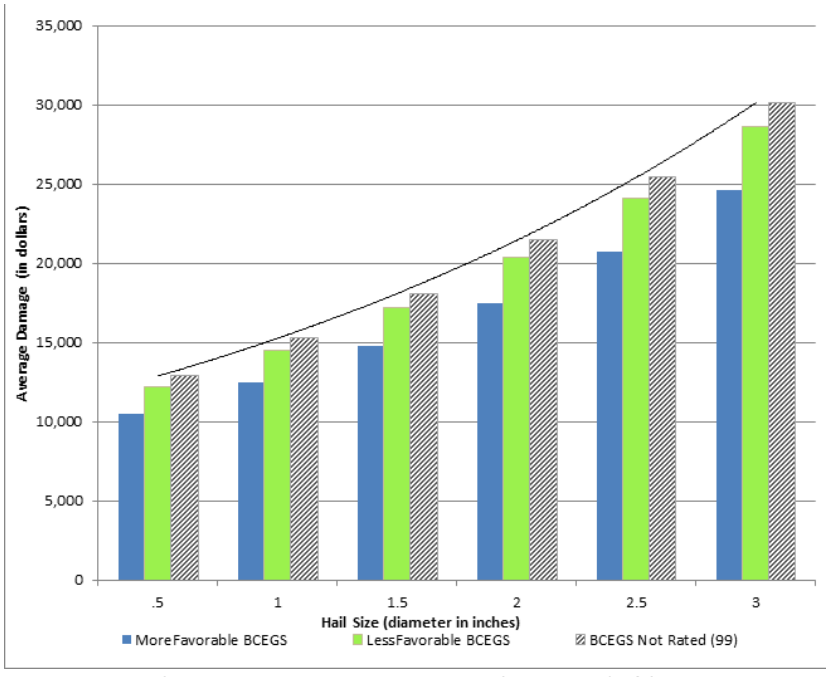

FIGURE 2. EXPECTED HAIL DAMAGE BY HAIL SIZE AND BCEGS RATINGS

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About the Wharton Risk Center

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Kevin Simmons (ksimmons@austincollege.edu) holds the Clara R and Leo F Corrigan Chair of Economics at Austin College. Dr. Simmons received his Ph.D. in Economics at Texas Tech University where he developed an interest in the economics of natural hazards. In 2011, Dr. Simmons published a book, *Economic and Societal Impacts of Tornadoes*. This was followed by a second book, *Deadly Season: Analyzing the 2011 Tornado Outbreaks* in spring 2012. Both books are co-authored with Daniel Sutter and are published by the American Meteorological Society and distributed by the University of Chicago Press. In 2010, he served as a Fulbright Scholar in Norway and will again serve as a Fulbright Scholar in Canada in 2014. His research has been highlighted and he has been interviewed by the *New York Times*, *CBS Evening News*, *Fox Business*, *Bloomberg TV*, *Christian Science Monitor* and *USA Today* among others. Funding for his research has come from NOAA, NIST and the National Science Foundation. In addition he has received funding from various insurance related institutes, the Institute for Catastrophic Loss Reduction (Toronto, ON) and the Insurance Institute for Business and Home Safety (Tampa, FL).