Research Brief

The Florida insurance market: An analysis of vulnerabilities to future hurricane losses

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Insurance regulators need a method to evaluate systemic risk from natural catastrophes. Current rating agency methods using traditional risk metrics account for a fraction of potential catastrophe losses and provide a very limited view of an insurer's solvency. Furthermore, Probable Maximum Loss (PML) levels currently employed for insurance rating of individual companies do not capture the systemic risk of an entire insurance market to natural catastrophe events.

The Characteristic Event (CE) methodology provides additional risk metrics that capture the full scope of potential losses from major perils, including hurricanes, earthquakes, and severe convective storms and are better suited to evaluate the systematic risk at a state level. As a case study, CEs were used to test the Florida insurance market to determine the solvency of private and public insurers and Florida's public risk financing entities – Citizens Property Insurance Corporation (Citizens), the Florida Hurricane Catastrophe Fund (FHCF), and the Florida Insurance Guaranty Association (FIGA).

Regulators need a consistent metric by which to evaluate the solvency of individual insurers and the insurance market	• Risk metrics need to be stable year to year to provide a robust view of changes in the financial strength of individual insurers. • Insurance systems that rely on interdependent individual markets need to be stress tested collectively to ensure the solvency of direct insurers and government insuring entities alike to determine what cost would be passed on to taxpayers in the event of a major catastrophe.
Probable Maximum Loss (PML) levels derived from catastrophe models alone are insufficient to capture the nuances of natural catastrophe impacts.	• Very little research has been conducted to test the viability of current methods employed to evaluate insurers. • PMLs lack the consistency, transparency, and stability needed by regulators for a robust rating methodology. • PMLs are not additive and cannot be used collectively to stress test an insurance system. • Individual catastrophe models can be updated and differ year to year, and thereby cause their PMLs to differ and thus contribute to the inability of the PML to evaluate insurer surplus over time.
Current views of risk using historical storms to stress test insurers provide a very limited perspective of potential events.	• Current stress tests conducted by regulators include requiring insurers to provide loss estimates for specific historical storms, but this does not represent the full range of potential events that an insurer could experience as future events are unlikely to be exact replicas of historical ones. • This method does not account for impacts on the market when multiple insurers have their reinsurance layers triggered due to a major event and provides no view of systemic risk.
Characteristic Events (CEs) can be applied to individual insurers and insurance markets.	• CEs are a suite of simulated events that are generated by analyzing the likelihood of a specific event occurring at a specified time period of interest to insurers (e.g., the 100 or 250-year hurricane). • They evaluate the likelihood of event impacts at every vulnerable location and provide complete geographic coverage of catastrophe risk potential. • CEs are an additive risk metric and can be used to evaluate the financial strength of an individual insurer or an entire market. • Using this methodology, individual insurers and entire insurance markets can be stress tested.

The Florida Insurance Market Characteristic Event (CE) Analysis

On average, Florida is hit with a hurricane every other year. Florida has been lucky for the past two decades. The 10-year period from 2006 to 2015 with no landfalling hurricanes was unprecedented in the historical record. In the 1920s, Florida experienced 10 landfalling hurricanes, including two Category 4 storms that would each result in more than $75 billion of insured losses if they occurred today.

This study illustrates a methodology that would enable Florida policymakers to more fully quantify the current vulnerabilities of the residential property insurance market in Florida in order to strengthen and enhance the resiliency of the system. Even though the natural perils and characteristics of the insurance marketplace vary from state to state, this same methodology could be applied by regulators to better quantify and manage individual insurance entities and the systematic risk to the insurance market in the state.

Study methodology

The set of hurricane events used for the analysis was selected to provide meaningful comparisons between insurers. Landfall points were positioned at 10-mile increments along the entire Florida coastline. At each landfall point, the characteristics of three types of hurricanes were defined: the 20-, 50-, and 100- year hazard probability events.

Because hurricane risk changes along the Florida coast, the event characteristics must vary by landfall point in order to keep the hazard probability the same. For example, the 100-year hurricane in Southeast Florida is a Category 5 hurricane, but in parts of Northeast and Northwest Florida, it is a Category 4 storm. Likewise, the 20- and 50-year hurricane characteristics vary by region within Florida.

As long as the events are credible from a meteorological perspective, the exact parameters selected for each storm are not critical for the analyses. What is important is that the same comprehensive set of storms is applied to each insurer. This is the only reliable way insurers can be compared with respect to hurricane vulnerability and financial solvency.

The loss estimates for this study were generated using the Karen Clark and Company (KCC) high-resolution hurricane model. In addition to the traditional EP curve metrics, the KCC model produces loss estimates for different return period events—the CEs.

Overview of individual insurer analyses and assumptions

For each Florida insurer, the losses for the 333 hurricanes in the 20-, 50- and 100-year CE event sets were estimated. A fully probabilistic loss analysis was also conducted for each insurer to estimate the EP (exceedance probability) curve and the 100-year PML.

To estimate each insurer's net loss, a number of assumptions were made regarding their reinsurance programs. It was assumed that each insurer buys risk transfer protection up to 75% of the KCC model-generated 100-year PML. The KCC hurricane model PMLs tend to be above the midpoint range of other vendor hurricane catastrophe models. Therefore, 75% of the KCC PMLs will be close to the average PML for the five models found acceptable by the Florida Commission on Hurricane Loss Projection Methodology (FCHLPM). While this assumption will not be correct for every insurer, it should not bias the results.

Private reinsurance retentions were set at the minimum of 10% of surplus or the FHCF retention amount. Rating agency guidance indicates Florida insurers should have a retention equal to 15% of surplus or less. Companies for which their retentions were publicly available had an average retention of 10% of surplus. For several insurers, their private reinsurance programs were publicly available. The surplus figures were taken from the 2016 year-end numbers as reported in FLOIR's 2017 annual report.

For each insurer, the following was calculated:

- Gross losses for each CE
- 100-year PML
- Recoveries from the FHCF
- Recoveries from private risk transfer programs
- Surplus minus net losses
- Normalized solvency ratio (NSR)

The NSR is the rate adjusted normalized net surplus ratio for all the 100-year events. Rather than representing an absolute value, the NSR reflects the probability of how often an insurer would become insolvent given the event set and provides a normalized metric that can be used to compare different insurers.

$$NSR = \sum_{i=1}^{n}\left(Normalized\ Net\ Surplus_{FL\ 100\ Event_i} * \left(\frac{Event\ Rate_{FL\ 100\ Event_i}}{\sum Event\ Rate_{FL\ 100\ Event_i}}\right)\right)$$

Results for Insurers

An insurer with an NSR > 0 has an expected positive surplus from the 100-year events. As the NSR becomes more negative, the insurer has a higher probability of insolvency from a 100-year hurricane.

The NSR illustrates the wide disparity between Florida insurers. Twenty-six (42%) have positive NSRs and can be considered the most financially secure domestic insurers. On the other extreme, eight insurers (13%) have NSRs of -2 or less, indicating a relatively high likelihood of experiencing insolvency from a hurricane. All these insurers are rated "A" or better by Demotech. This information indicates that existing rating methodologies, which rely heavily on the PMLs, do not sufficiently differentiate insurers with respect to financial stability.

The study results also imply that the current FLOIR stress tests based on three historical hurricanes are not comprehensive enough to identify insurers that are vulnerable to hurricane losses. More comprehensive stress tests along with an improved insurer rating agency methodology would strengthen the Florida residential property insurance market.

Results for Florida's Public Risk Financing Entities

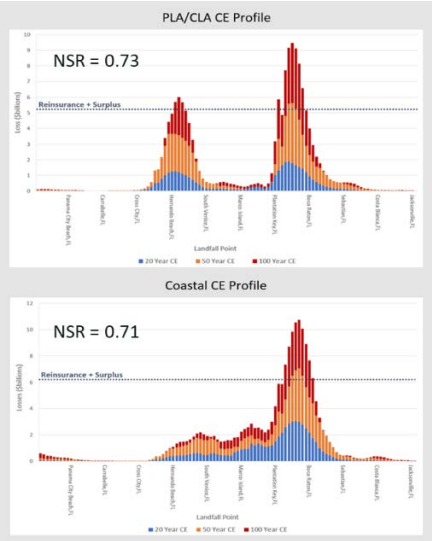
The second part of the study examined the impacts of the 20-, 50- and 100-year hurricanes on Citizens, the FHCF and FIGA.

Citizens

Notably, Citizens is financially secure due in large part to the amount of its surplus. Citizens Coastal Account has an NSR of 0.71, and Citizens Personal Lines Account (PLA)/Commercial Lines Account (CLA) has an NSR of 0.73, among the highest of all Florida insurers.

Figure 1 shows the losses from the 20-, 50- and 100-year hurricanes (vertical axis) by landfall point (horizontal axis), commonly referred to as the CE profile for Citizens PLA/CLA and Citizens Coastal Account (CA). The highest bars indicate where the insurer has exposure concentrations and is most vulnerable to hurricane landfalls. The amount of reinsurance (private plus FHCF) and surplus available is shown by the dotted line.

Figure 1 - Citizens CLA/PLA Profile



FHCF

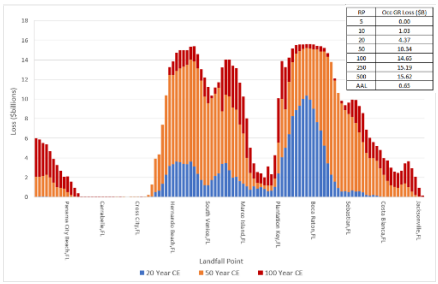
To estimate the FHCF payout for each CE, the FHCF coverage level, coverage amount, and retention were first calculated for each participating insurer. More specifically, the coverage level and FHCF reimbursement premium reported by each company under the 2017–2018 FHCF annual reimbursement contract was obtained. Pursuant to the contract, each participating insurer's retention is calculated as the FHCF reimbursement premium multiplied by the retention multiple outlined in Figure 2.

Figure 2: Coverage and Retention Multiples

Coverage Level (%)	Retention Multiple
90	5.1028
75	6.1234
45	10.2056

Each insurer's coverage amount is calculated as 14.9294 (the payout multiple) multiplied by the insurer's reported FHCF reimbursement premium. The FHCF recovery for each participating insurer was estimated for each event, and the cumulative FHCF payout by event was estimated as the sum of FHCF recoveries for each participating insurer. Figure 3 shows the FHCF payout by event, by landfall point.

Figure 3: FHCF CE Profile



The FHCF's statutory maximum limit for the 2017–2018 reimbursement contract year is $17 billion. From the FHCF's CE profile, it can be noted that a one in 500-year loss is not expected to exhaust the FHCF's maximum limit, but would exhaust only $15.62 billion of the $17 billion limit. For the FHCF's statutory limit to be exhausted, all participating insurers would need to exhaust their FHCF coverage limit. Additionally, this result implies that the cost of

risk transfer products should reflect the FHCF's lower probabilities at the upper layers of coverage. The methodology used here illustrates an improvement over the crude methodology that has been used historically to price FHCF risk transfer coverage.

FIGA

The study results can be used to quantify the number of insurers likely to become insolvent, defined as an insurer having a loss exceeding the insurer's risk transfer program, under different industry loss scenarios. Figure 4 shows the expected number of insolvencies by industry loss.

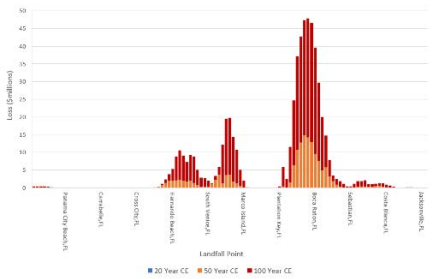
Figure 4: Companies Exceeding Risk Transfer Program

Industry Loss Range ($B)	# of Companies Exceeding their Reinsurance Programs
<25	0
25 to 50	11
50 to 75	20
75 to 100	37
>100	48

The results indicate that at an industry loss size between $50 billion and $75 billion, 20 Florida insurers could become insolvent. This number is notable because most models agree that Hurricane Andrew would cause $50 billion to $60 billion if it occurred today. This means that more companies would become insolvent today than in 1992 from an Andrew-size loss. It is important to note that not all $60 billion events would cause 20 insolvencies. The number of insolvencies depends heavily on where the hurricane makes landfall.

FIGA is most exposed to hurricane landfalls near Miami, as noted from Figure 5, where event losses can exceed risk transfer programs by several multiples. In extreme cases, the FIGA's debt obligations can exceed $40 billion. However, FIGA is limited in its statutory authority to fund insolvencies. A hurricane event on the order of Hurricane Andrew could exhaust its financing capabilities (Florida Guaranty Insurance Association, 2018). Results of the analysis indicate that it does not take a one in 100-year event to stress FIGA's capabilities to the limit. FIGA is vulnerable to the potential volatility of the financial markets following an event and by its limited assessment authority.

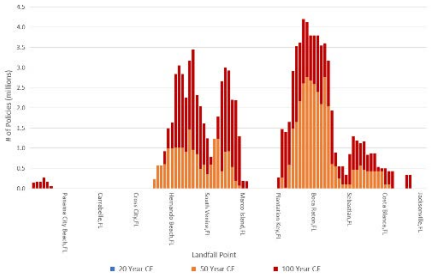
Figure 5: FIGA Debt Profile



This study also assessed the number of policies from the insolvent insurers that would be renewed by Citizens post-event.

At its maximum historical policyholder count, Citizens had almost 1.5 million policies in its combined PLA/CLA and CA. At the end of 2017, the combined policy count was 440,406. Figure 6 illustrates that there are a large number of one in 50-year hurricanes that could result in the repopulation of Citizens to its historical maximum policy count. Additionally, a number of the one in 50-year hurricane events could result in a surge of policies by inundating Citizens with an extra 1 million policies or more, far surpassing the historical record. For certain landfall locations, a one in 100-year hurricane event could result in the Citizens policy count exceeding 4 million policyholders, which represent about two-thirds of all policyholders in the state. Citizens, FIGA and the entire Florida residential property insurance market are highly vulnerable to insurer insolvencies, which could arise from moderate to large hurricane events that are not extreme, but that could easily occur in the future.

Figure 6: Policies to Citizens from Insurer Solvencies



Broader applications of the CE methodology

The CE methodology provides a reliable risk metric with which to evaluate individual insurers and the broader insurance market. A number of natural catastrophe perils, including earthquakes and severe storms, can be evaluated in any region using a similar approach.

The results of such analyses offer insight into vulnerable insurers to determine the potential loss from an event that would be passed on to higher layers of insurance or the taxpayer. Because this methodology relies on an event set unbiased by location and offering full geographic coverage, the full range of potential events is captured by the loss metrics. CEs are the only risk metric currently in use that can be used for both rating individual insurers and evaluating the systemic risk of an insurance market.