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Exposure Management: Utilizing Population Density

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Last time we covered data quality and its importance as part of an exposure management strategy. The next step is determining exposed limits or the total financial exposure faced by an insurance company based on contractual obligations. There are several different ways to determine exposed limits. A quick and dirty method is to add up policy limits across a geographical area. It's more usual and precise to sum location values (TIV) by geographical area and subtract attachment point and deductibles, capping the value at the policy limit or taking the policy share if the TIV falls below the policy limit but above the attachment point.

Until recently, limit analysis in the United States has aggregated exposure on postal code, county, and state. But these more or less arbitrary boundaries mask important information about how population distribution affects the accuracy of our results. A growing consensus has it that a "population density" based approach gives a much more accurate account of exposed risk.

By taking a population density approach, a company can aggregate risk in highly populated areas to have a better understanding of their aggregate exposure and maximum expected loss. Rarely does a CAT event affect a single postal code or county. A major CAT event often affects multiple postal codes, counties and in many cases multiple states. Hurricanes can differ dramatically in size and the thought of multiple earthquake fault eruption across a wide area is also obviously a concern. This is why developing internal exposure metrics are extremely important to manage risk. In other words, most insured values are where people live and work. Most people commute less than 30 miles from their residence to their work. Therefore if you understand where people actually live you will understand where exposure is actually at risk and most of the time this exposure is not constrained by state, county or postal code boundaries.

For example, when looking at the Eastern US seaboard we see that postal codes, counties, and even state boundaries have very little bearing on population density, especially around the areas of Washington DC, New York City and Boston. Relying on exhibits that display risk by state, county or postal code can create a false sense of security. The population density approach will give a significantly more accurate and intuitive view of exposure by removing artificial boundaries. Another away to understand this approach is if exposure in New York City is an issue, you must also understand the exposure in New Jersey and Connecticut. But grouping all exposure of all three states will prove to overstate risk. Using a population density map of the tri-state area will better focus the aggregation approach.

The crux of this approach is to base our analysis on geographical areas that explicitly take into account TIV and population distribution. These are often called "gates" and comprise a set of postal codes with a common TIV and population density levels. Modeling vendors provide databases of TIV values at postal code level, but they don't do the heavy lifting that enables you to determine what constitutes a gate, this TIV must be supplemented by population data and it's up to you to

determine the postal codes to aggregate. A great example here would be Tampa. An aggregate view of Tampa should include Hillsborough, Pinellas and Manatee counties. Simply viewing exposure in Tampa or in Hillsborough County would understate exposed risk by not including the two other counties where a large portion of people reside. In our practice we have found that an analysis based on 23 population wind hubs on the East Coast of the US is very effective.

Such a population based aggregation is also useful for dealing with earthquake and terrorism risk for workers compensation coverage. The approach recommended is to view these events as occurring during peak work hours. Understanding the number of employees working in insured building is crucial for developing exposure estimates. Referencing population hubs is ideal for aggregating workers comp risk exposure in the United States.

It must also be stated that plotting and viewing exposure in this manner has a serious drawn-back when aggregating east coast wind aggregating east coast wind exposure. When location valves are summed and compared to policy attachment points, deductibles and limits in this geographical aggregation method you basically lose the ability to accurately view multiple landfall events when dealing with hurricane loss. In other words, by taking this approach one policy limit will often be exhausted in a geographical area and therefore adding up limits across multiple areas would overstate expected loss in a multi-landfall event. This is a serious condition that must be considered when using this approach.

In summary, the quality of data at the location level is extremely important to generate good modeled results. However when aggregating exposure to view actual risk a company should look outside the box and view risk by Population Density. A common technique is to set up 23 population wind hubs on the east coast of the US.

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