**Original Paper:** Pominova, M., Gabe, T., and A. Crawley. 2022. The Stability of Location Quotients. *The Review of Regional Studies.* 52: 296-320.

# Summary

The paper investigates the reliability of location quotients (LQs) as a measure of industry specialization, particularly in small regions.

The paper assesses the stability of LQs by examining the response to marginal changes (i.e. a 1-unit increase) in the # of business establishments within a particular region-industry pair, highlighting how small regions with low population sizes are sensitive to such changes, leading to highly unstable LQs.

**Original LQ Calculation:** compares the concentration of a particular industry in a region to the concentration of that same industry in a larger benchmark region (e.g. a country). The formula is:

where is the employment (or number of establishments) in industry for region . is the total employment (or number of establishments) in region . is the employment (or number of establishments) in industry in the benchmark region . is employment or (or number of establishments) in the benchmark region .

**Adjusted LQ Calculation:** to examine stability of the LQs, the paper proposes adding one hypothetical establishment to the industry in the region and the total number of establishments in the region. This helps assess how sensitive the LQ is to marginal changes.

**Comparison:** The difference between the original and adjusted LQ shows how much the LQ changes when the number of establishments in the region is marginally increased by one. To quantify this stability, the paper introduces a measure called the “standardized difference”, calculated as the square root of the average squared difference between the actual and adjusted LQs across all industries in a region.

**Extension Logic:**

The use of actuarial credibility theory to “stabilize” LQs by blending the specific LQ for a small region with a more stable, broader benchmark LQ. This approach reduces the impact of small sample sizes and marginal changes in small regions, leading to more reliable LQ estimates.

**Credibility Theory** provides a way to combine individual (region-specific) estimates with broader (benchmark) estimates based on the “credibility” of the individual estimate. The key idea is to assign a weight (credibility factor) to the region-specific LQ based on the size or reliability of the data. The credibility-weighted LQ can be expressed as:

Where is the credibility-weighted LQ; is the LQ calculated for a specific region; is the LQ calculated for the larger, stable benchmark region. is the credibility factor, which ranges from 0 to 1 and is determined by the volume or reliability of the data for the region.

NOTE: values in industry are based on surveys (62% response rate).

Z is typically calculated based on the size of the data sample in the region. A common formula is:

Where is the number of establishments in the region; and is a constant that represents the threshold for full credibility. NOTE: The choice of K is critical and has to be intelligently selected and defensible. If we can’t arrive at a precise K, we can demonstrate what happens across a spectrum of possible values.

**Potential Drawbacks:**

* Determining the Credibility Constant (K) – the choice of K is crucial. IF it’s too large, the region-specific data could be underweighted. If too small, the benefits of stabilization are reduced. You could determine K empirically by examining the stability of LQs across different region sizes.

OTHER NOTES:

* JRAP might be a good fit, but we need to decide whether this is a method extension or just an application.
* It may be good to demonstrate the effectiveness with an actual model. E.g. could we predict county-level agricultural insurance loss ratios using raw LQs and then show that stabilized LQs (via the credibility adjustment) produce more accurate results?

NEXT STEPS:

* Mariya to send data/code.
* Chris to investigate literature on selecting K.

# Estimating K

K is a constant, typically determined by the ratio of Expected Value of Process Variance (EPV) to the Variance of the Hypothetical Means (VHM).

EPV measures the variability within regions (across industries).

Where is the proportion of employment in industry i within region r.

Est