Evaluating Compliance with COD Standards

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Abstract: The IAAO and many state/provincial agencies have adopted assessment uniformity standards as measured by the COD. Of course, it is well recognized that actual CODs will sometimes fall outside of required standards due to small sample sizes. In the case of central tendency measures (median, mean, and weighted mean) this is addressed through the use of confidence intervals. If the calculated measure of central tendency is sufficiently far from the required standard and the sample size is sufficiently large, the level of assessment is deeded to be in noncompliance. Unfortunately, unlike measures of central tendency, there are no published formulas for calculating confidence intervals for the COD. This article presents a simple table for determining whether COD standards have been achieved1.

Background

There are three primary aspects of valuation performance: overall level, equity between property groups, and equity within property groups. The assessment industry has developed standards in all three areas and assessment agencies naturally desire to quantify performance in each area as accurately as possible. To this end, confidence intervals are used to measure the precision of computed assessment levels as measured by the median, mean, and weighted mean to determine whether one can assume with reasonable confidence that required measures have not met. Similarly, statistical tests can readily be applied to determine whether assessment levels for two or more property groups are reasonably similar.

The primary gauge of equity among individual properties *within* a property use class, neighborhood, or other group is the coefficient of dispersion (COD), which measures the average percentage deviation about the median ratio. IAAO and many state/provincial agencies have adopted standards for the COD and reappraisal contracts often call for the contractor to attain specified CODs. Of course, a computed COD, just like a computed measure of the assessment level, is only an indicator of true performance. The accuracy of the measure depends on sample size and distribution. Clearly, there is a need to determine with reasonable confidence whether assessment uniformity standards, like assessment level standards, have been achieved.

Current Methodology and Limitations

If ratio data were always normally distributed, confidence intervals for the COD could be constructed. Unfortunately, ratio data does not always approximate a normal distribution. An alternative approach that does not require a normal distribution is use of a repeat sampling or

1 For a statistical explanation of the methodology and its application to sample jurisdictions, see Robert J. Gloudemans, "Confidence Intervals for the Coefficient of Dispersion," *Assessment Journal*, vol 8, no 6 (Nov/Dec 2001).

"bootstrap" methodology. In this case, one draws a large number of samples with replacement of size *n* from the sample, calculates the COD for each draw, and determines the cut points (confidence limits) that correspond to the desired confidence level. For example, if a 95% confidence interval is desired, one could draw 1,000 samples (with replacement). The lower confidence limit would fall between the 25th and 26th smallest CODs and the upper limit would lie between the 975th and 976th largest CODs. Unfortunately, bootstrap confidence intervals are not part of software packages generally found in an assessor's office and require special (complex) programming. To the author's knowledge, only the State of Kansas uses this method.

The biggest problems with confidence intervals for the COD, however, go beyond the above limitations. As is well known, as the dispersion of the data increases, confidence intervals widen. This is particularly problematic with measures of dispersion, because dispersion is precisely what is being measured. The worse the COD, the wider the confidence interval. Thus, poor dispersion masks or excuses poor dispersion!

A better measurement tool is needed if standards for the COD are to have credibility and if tests of uniformity are to be commonly and easily conducted.

Solution

Rather than attempting to compute confidence intervals for the COD, consider an approach in which one tests the hypothesis that the COD complies with goals or standards, which may be based on state/provincial requirements, professional guidelines, or in-house policy.

Hypothesis: True COD $\leq$ Target/Required COD

What is the maximum value of the *calculated* COD that can be accepted before the above hypothesis can no longer be supported with a desired degree of confidence (typically 95%)? This restates the problem in the form of a test. To make a straightforward solution possible, assume that the standard against which the calculated COD will be compared is a normal distribution with a COD equal to the target or required COD. This does not imply that actual ratios must be normally distributed (they may well not be), but only that the average dispersion about the median is not significantly worse. Thus, the benchmark distribution is a normal distribution with a COD equal to the target or required COD. If the calculated COD is too far from the standard given the available sample size, the hypothesis of compliance is rejected. Otherwise it is accepted.

Given this framework, the maximum COD that can be accepted before one can conclude that standards have not been met can be calculated and benchmark values been set out in the in the table below for typical COD standards and sample sizes. For example, assuming a standard of 15 and a sample size of 25, one can conclude that the true COD exceeds 15 only if the calculated COD exceeds 18.48.

Conclusions

Assessing officials almost universally strive for good uniformity as measured by the COD and should rightfully be concerned when calculated CODs seem out of compliance with goals or

standards. At the same time, however, sometimes seemingly “bad” CODs may be attributable to sampling errors due to small samples. The table developed here provides a ready basis for determining when a desired COD has not been achieved and properties should therefore be reappraised.

Maximum Acceptable CODs for Compliance with Standards

	COD Standard		
N	10.00	15.00	20.00
5	15.40	23.10	30.80
6	14.88	22.32	29.76
7	14.49	21.73	28.97
8	14.18	21.26	28.35
9	13.92	20.88	27.85
10	13.71	20.57	27.42
11	13.53	20.30	27.06
12	13.37	20.06	26.75
13	13.24	19.86	26.47
14	13.12	19.67	26.23
15	13.01	19.51	26.01
16	12.91	19.36	25.82
17	12.82	19.23	25.64
18	12.74	19.11	25.48
19	12.66	19.00	25.33
20	12.60	18.89	25.19
21	12.53	18.80	25.06
22	12.47	18.71	24.95
23	12.42	18.63	24.84
24	12.37	18.55	24.73
25	12.32	18.48	24.64
26	12.27	18.41	24.54
27	12.23	18.34	24.46
28	12.19	18.28	24.38
29	12.15	18.23	24.30
30	12.11	18.17	24.23
35	11.96	17.93	23.91
40	11.83	17.74	23.66
45	11.72	17.59	23.45
50	11.64	17.45	23.27
60	11.49	17.24	22.99
70	11.38	17.07	22.76
80	11.29	16.94	22.59
90	11.22	16.83	22.44
100	11.16	16.73	22.31
200	10.82	16.23	21.64
300	10.67	16.00	21.34
400	10.58	15.87	21.16
500	10.52	15.78	21.04