Ratio Study Summary

September 15

2013

Arkansas Assessment Coordination Department
1614 West Third Street
Little Rock, AR 72201

1. STUDY METHODOLOGY

1.1 Data Preparation

In accordance with ACD rules, counties and their contractors provided ACD with a file of all real property parcels in 2013. The files, provided in Excel format, contained relevant property characteristics, valuation, and sales data as called for in Rule 4.04.1b. We converted these files to a common SPSS format for analysis, checked for duplicate parcels, and removed exempt and other properties outside the scope of the study. Relevant property types were classified as residential improved (RI), commercial improved (CI), or vacant land (VA).

Based on deed types and validation codes we identified sales usable for ratio analysis. We considered only warranty and special warranty deeds and excluded all validation codes enumerated in ACD rules other than VS, VA, UV, or AP.[1] In accordance with ACD rules, we eliminated the lowest 10% properties in their class (RI, CI, or VA), as well as any sales with prices that fell below the threshold value for their class. We combined appraised values for commercial multiple parcel sales and eliminated residential or vacant multiple parcel sales. We also performed a special analysis of unverified (UV) sales in which we compared the distribution of ratios for these sales with those of validated sales. We removed extreme ratios for UV sales that both (a) lied outside the distribution of validated sales and (b) fell below 0.25 or above 2.00. Section 1.3 below describes general outlier analysis.

Per ACD rules we used one year of residential and vacant land sales and two years of commercial sales in counties with 50,000 or more real property parcels (Jefferson). For other counties we used two years of residential and vacant sales and three years of commercial sales.

At the conclusion of exploratory data analysis and sales screening we saved a data file containing both sold and unsold parcels for use in subsequent analyses.

1.2 Time Trend Analysis

Sales were adjusted for statistically significant changes in price levels over the relevant study period. Using the sales ratio trend method we conducted a separate analysis for each property type in each county with adequate sales[2]. In each case we began by plotting sale-to-assessment ratios (SARs) against time and temporarily filtering outlier SARs. We studied plots

[1] We also excluded other validation codes not defined in ACD rules that counties or their contractors used to flag invalid sales.

[2] For a more detailed discussion of the sales ratio trend method of time adjustment, see Robert Gloudemans, *Mass Appraisal or Real Property* (IAAO, 1999), pages 265-268 or Robert Gloudemans and Richard Almy, *Fundamentals for Mass Appraisal* (IAAO, 2011), pages 151-155.

to determine whether trends could be approximated with a straight line. If not, "splines" (multiple straight lines) were defined to approximate the indicated pattern.

Regression analysis was used to test for statistical significance and quantify significant trends. The dependent variable in these analyses was the logarithm of SARs and the independent variable was Months (e.g., 1-24 for two years of data) or segments thereof. For example, if the market appeared to be flat in the first 15 months and then increase over the remaining 9 months, we would test two splines: Months1 (1-15) and Months2 (0-9). For a sale occurring in month 20, Months1 would be coded as 15 and Months2 as 5, since the sale price would reflect any price changes over all 20 months. If the sale occurred in month10, Month1 would be coded as 10 and Months2 as 0. The logarithm of SAR was used in order to determine percentage changes. If a time trend was found, sales prices were adjusted to the end of the study period at the indicated rate or rates.

1.3 Outlier Analysis

With sales adjusted for time as necessary, we analyzed ratios for outliers and removed those that would compromise the validity of ratio statistics. The analysis began by plotting the distribution of sales ratios on both raw and logarithmic format. We tagged any ratios that were more than 1.5 times the inter-quartile range (IQR) below the 25th percentile or above the 75th percentile. However, in no case did we trim ratios between 0.60 and 1.40. The resulting trim points and distribution of tagged and untagged sales was analyzed and trim points adjusted as necessary to make logical sense, that is, to ensure that obvious outliers were excluded but that ratios constituting a smooth progression were retained.

A guiding principle in the outlier analysis was, where possible, to remove no more than 5% of ratios for a given property type in a given county. However, when samples were small or ratios exhibited wide dispersion, this general rule was relaxed with the caveats that (a) no more than 10% of ratios in a class were removed and (b) no more than 5.5% of all ratios were removed.

1.4 Ratio Analysis

Once outliers were removed, we calculated key ratio statistics for each of the three property types. For each property type, we calculated and reported the number of sales, median ratio, 95% confidence interval for the median, coefficient of dispersion (COD), and price-related differential (PRD). These statistics were also reported by market area, city, and school district.

Separately, using additional sample data provided by ACD, we calculated median ratios, 95% confidence interval for the median, and coefficient of dispersion (COD) for agricultural and business personal property; median ratios for non-business personal property (autos) were also incorporated into the study.

Using total assessed values calculated for each of the three major study classes, we divided assessed values by median ratios to obtain estimated total market values for each class. Similarly, using abstract data provided to ACD by counties or their contractors, we divided assessed value for agricultural, business personal and non-business personal property by their respective medians (usually 20%) to obtain estimated market values for each of these property classes. Finally, we summed assessed values and estimated market values for the six property types and divided aggregate assessed value by aggregate market value to obtain the estimated overall assessment ratio. According to ACD standards this ratio must be between 18% and 22%. In addition, the 95% confidence interval for each of the three major classes must overlap 0.18 to 0.22, as must the 95% confidence interval for residential property and vacant land in each market area. CODs must also comply with requirements set out in ACD rules.

1.5 Sold Versus Unsold Parcels

ACD's rules require the agency to "vigilantly monitor whether counties are appraising unsold properties in the same manner as sold properties." To this end we compared median and average value changes for each of the three property classes and highlighted cases where differences exceeded 10%. We also used the Mann-Whitney test to determine the statistically reliability of observed differences. These analyses were conducted after removing the lowest 5% and highest 5% of value changes for both sold and unsold properties in each of the three classes. Indicated cut points were further adjusted if required to remove unusually large changes.

If initial analysis indicated statistically significant changes of more than 10% based on either the median or mean ratio, we conducted supplemental analyses at the market area and/or neighborhood level. In some cases we compared the percentage of sold and unsold properties for which values were changed and the percentage for which changes exceeded meaningfully thresholds, say 10% or 20%. Based on these comparisons we highlighted instances of systematic differences in value changes between sold and unsold parcels.

2. SUMMARY OF FINDINGS

Attachment 1 summarizes results for the 11 counties included in the 2013 study. In all cases, the level of assessment complies with ACD rules. In all cases, appraisal uniformity (COD) complies with ACD rules.

Statistically significant time trends were found in four counties. The largest was a cumulative downtrend of 5.9% over two years (2011 and 2012) for residential property in Lawrence County. In two cases, residential properties in Jefferson & Union Counties, we found an increase in values.

As the final column to the table indicates, in all cases the "Sold versus Unsold Parcels" test complies with ACD rules. Three of the counties failed the initial test on vacant land, so further in-depth analysis at the neighborhood level was performed. Although overall comparisons indicated significant differences, changes within neighborhoods were similar so the county was issued a pass on the final test.

3. RELEVANT ISSUES

A number of issues arose during the course of the study. The most important related to which deed types and sale validation codes are usable in the study. Rule 4.04.1b directs counties to supply ACD with a list of all warranty and special warranty deed for the time frame covered in the ratio study. However, there are no official definitions of deed type codes and counties declare and define these individually. Submitted deed type codes are numerous and sometimes missing, making it difficult to determine whether sales are in fact warranty or special warranty deeds. For example, "CP" represents corporate warranty deeds in some counties and contract for purchase sales in others.

More importantly, while ACD rules provide a list of allowable rejection codes for invalidating sales to be considered in the study, submitted validation codes sometimes deviated from defined codes, were simply marked "UV" (unverified), or left blank. Attachment 2 shows the percentage of sales assigned valid and invalid verification codes in each county, as well as the percentage coded "UV" or (less frequently) left blank. The percentage of sales affirmatively assigned valid sales codes (VA, VS, or AP) ranges from 18% to 68%, while the percentage of sales affirmatively assigned invalid sales codes ranges from 19% to 57%. Overall, 22% of sales were assigned "UV" or blank codes, with the percentage ranging from 5% to 43%. While a low percentage of usable sales can be partly explained by the fact that many unusable sales are likely other than warranty or special warranty deeds, the wide ranges indicates considerable diversity in the way sales are coded in each county.

There is nothing in ACD rules to condone the automatic elimination of "UV" or blank sales and IAAO standards call for retaining sales unless there is a specific reason for rejecting the sale. In any case, this year's study considers only sales that appear to be warranty or special warranty deeds. It retains UV validation codes, which are subject to special outlier analysis as explained previously. However, validation codes not defined in ACD rules were not used. All verified (VA, VS, AP) and unverified (UV) sales were subject to routine outlier analysis.

The following other issues were encountered during the study:

- Parcel extracts submitted by the counties and contractors are not in a standardized layout and differed between the two CAMA software providers (ACT & AIS).

- Blank sales prices were very common in some counties. These reflected deeds that were filed with no revenue stamps. These sales were removed from the study.

- 20% values. On several county parcel extracts values appeared to reflect the 20% assessed value instead of the full market value. In two counties the previous values were listed as assessed and the current values were listed as full market value.

- Missing market areas and neighborhoods. Some counties have not defined market areas, in which case we treated the entire county as a single area (entirely reasonable for smaller counties). We reported ratio statistics for the various numeric and alphanumeric codes that appeared in the file.

ATTACHMENT 1
2013 Ratio Study
Summary of County Results

County	Property Class	Years	Sales	Median	LCL	UCL	COD	Time Trend	Solds vs Unsolds
Arkansas	Residential	2	188	19.33	19.00	19.66	10.70		Pass
	Commercial	3	11	19.83	15.04	23.00	13.00		Pass
	Vacant	2	19	20.00	19.04	20.33	5.50		Pass*
Ashley	Residential	2	135	19.86	19.40	20.30	12.30		Pass
	Commercial	3	18	19.41	19.14	20.18	6.60		Pass
	Vacant	2	26	18.07	16.75	19.50	17.40		Pass*
Clay	Residential	2	139	19.86	19.34	20.71	12.50	0.965	Pass
	Commercial	3	13	21.58	19.56	23.34	9.60		Pass
	Vacant	2	13	19.83	19.20	20.00	5.90		Pass
Columbia	Residential	2	292	19.57	19.20	19.86	11.90		Pass
	Commercial	3	29	19.32	18.79	22.48	15.30		Pass
	Vacant	2	18	20.22	18.75	24.00	13.30		Pass
Crawford	Residential	2	754	19.05	18.88	19.21	9.60		Pass
	Commercial	3	39	19.60	18.15	20.23	12.60		Pass
	Vacant	2	74	20.11	18.75	21.43	17.20		Pass
Jefferson	Residential	1	203	19.23	18.87	19.47	8.91	1.05	Pass
	Commercial	2	12	18.46	15.65	19.30	7.96		Pass
	Vacant	1	14	20.04	19.88	22.86	7.37		Pass
Lawrence	Residential	2	124	20.56	20.04	20.92	10.80	0.941	Pass
	Commercial	3	13	20.40	18.34	25.67	14.10		Pass
	Vacant	2	17	20.00	15.83	20.42	17.10		Pass*
Montgomery	Residential	2	74	19.23	18.82	19.61	14.20		Pass
	Commercial	3	9	20.50	15.86	24.92	17.50		Pass
	Vacant	2	27	18.97	17.63	19.73	9.40		Pass
Polk	Residential	2	176	19.16	18.83	19.39	10.63		Pass
	Commercial	3	24	19.39	17.30	21.57	14.30		Pass
	Vacant	2	21	19.66	17.07	22.60	15.73		Pass
Randolph	Residential	2	240	18.93	18.49	19.31	18.00		Pass
	Commercial	3	28	18.99	17.13	22.52	16.50		Pass
	Vacant	2	47	20.00	20.00	20.00	14.30		Pass
Union	Residential	2	387	18.85	18.45	19.09	12.90	1.036	Pass
	Commercial	3	29	20.36	17.87	21.64	10.30		Pass
	Vacant	2	44	20.17	19.62	22.17	16.80		Pass

* Although overall comparison indicates signficant differences, changes within NBHDs are similar.

ATTACHMENT 2
2013 Ratio Study
Distribution of Validation Codes

County	Sales Considered	% Valid Usable Codes	% Valid Rejection Codes	% Undefined Codes	% Unverified Codes	Undefined Codes
Arkansas	547	29.07%	55.03%	0.00%	15.90%	
Ashley	356	43.82%	41.01%	5.34%	9.83%	QS
Clay	400	28.50%	57.00%	0.00%	14.50%	
Columbia	496	34.48%	22.78%	0.20%	42.54%	27
Crawford	1148	40.24%	19.43%	0.09%	40.24%	RS
Jefferson	448	38.17%	47.99%	0.00%	13.84%	
Lawrence	296	18.24%	44.93%	0.00%	36.82%	
Montgomery	176	61.36%	33.52%	0.00%	5.11%	
Polk	374	49.73%	39.57%	0.00%	10.70%	
Randolph	421	68.17%	19.00%	0.24%	12.59%	IA
Union	706	61.76%	32.58%	0.00%	5.67%	
Totals	**5368**	**42.92%**	**34.95%**	**0.41%**	**21.72%**	

Valid Sale Usable Codes: AP, VA, VS
Valid Sale Rejection Codes: AL, AS, CH, CS, CT, CV, DT, DV, ES, FD, FI, FS, GO, IS, MH, MU, NM, OF, OT, PI, PP, RC, RL, TR
Undefined Validation Codes: IA, QS, RS, 27
Unverified Sale Codes: UV or blank