Indiana Property Tax Equalization Study

Sullivan County Equalization Report

December 22, 2004

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County Report for Sullivan County
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This document summarizes the data, the equalization statistics, and the results of the Ratio Study performed on Sullivan County. The first section of this document entails specific results for Sullivan County, while the Appendices provide a general overview of the Indiana Property Tax Equalization Study, the processes used to complete the task, and detailed statistics for Sullivan County.

County Overview

Sullivan County is bordered by Clay, Greene, Knox, and Vigo counties and the Wabash River in southwest Indiana. Sullivan is the largest city (population 4,603) and the county seat. Sullivan County's population is 21,861 (2003),[1] ranking it 69th in population. There are nine townships in Sullivan County: Cass, Curry, Fairbanks, Gill, Haddon, Hamilton, Jackson, Jefferson, and Turman.

Sullivan County completed its March 1, 2002 Reassessment on July 28, 2003. The tax base for real property, including assessed value and number of parcels, by property class, is presented in Table 1 below.

Table 1
Real Property Assessed Values and Number of Parcels, Sullivan County

Real Property in Sullivan County	Residential	Commercial & Industrial	Agricultural	Utility & Other	Total
Number of Parcels	9,207	1,055	5,263	823	16,348
Assessed Value	$358,157,680	$106,528,200	$275,818,200	$50,994,220	$791,498,300

Ratio Study Data

Beginning in 2001 with the enactment of HEA 1499, IC 6-1.1-4-25 (b), Indiana Code stated:

> "the township assessor in a county having a consolidated city, or the county assessor in every other county, shall:
> (1) maintain an electronic data file of the parcel characteristics and parcel assessments of all parcels for each township in the county as of each assessment date that is in the form required by:
> (A) the legislative services agency (LSA); and
> (B) the department of local government finance; and
> (2) transmit the data with respect to the assessment date of each

[1] Population Statistics from Stats Indiana http://stats.indiana.edu/profiles/pr18001.html

year before October 1 of the year to:

(A) the legislative services agency; and

(B) the department of local government finance."[2]

In addition, the Act required, in I.C. 6-1.1-4-19.5, the Department of Local Government Finance (DLGF) to develop a standard contract or standard provisions for contracts to be used in securing professional appraisal services that include provisions stipulating:

- **"…**the contractor will generate complete parcel characteristics and parcel assessment data in a manner and format acceptable to the legislative services agency and the department of local government finance; and
- **…**the legislative services agency and the department of local government finance have unrestricted access to the contractor's work product under the contract."[3]

Simply stated, the Indiana General Assembly required local assessing officials to submit assessment data in a standard electronic file structure and format ("standardized format") developed by the DLGF, which met the requirements of the DLGF and the LSA.

In addition, 50 IAC 12-16-28 sets forth the electronic record layout for sales disclosure information administration under authority of IC 6-1.1-31.5, which required the DLGF to promulgate computer specification standards, including those for assessment and sales disclosure data.

The primary data required to perform an equalization analysis are parcel-by-parcel new and prior year assessments and market value information, specifically, the sales prices and property characteristics of recently sold properties. The collection and transmission of the assessment and sales data in accordance with statute and rule discussed above provide the means by which the Indiana Fiscal Policy Institute (IFPI) can perform the equalization study.

Because local officials and their software vendors, in some cases, did not comply with the data transmission requirements, the IFPI found it necessary to obtain sales disclosure data directly from the paper sales disclosure form (State Form 46201). The IFPI had the paper forms "digitized," that is, electronically scanned and the information on them converted to an electronic format which allowed them to be used in the equalization analysis. In addition, the IFPI obtained Multiple Listing Service (MLS) sales data from Boards of Realtors across the state with the assistance of the Indiana Association of Realtors in order to supplement the sales disclosure form data.

For Sullivan County, the IFPI evaluated the accuracy of the assessment of 15,525 parcels of residential, commercial and industrial, and agricultural property (see Table 1). This

[2] HEA 1499 - 2001, Section 16.
[3] HEA 1499 - 2001, Section 15.

was done by making a ratio study of the categories of property listed in 50 IAC 14 and by testing for "sales chasing" (the practice of assessing recently sold properties in a manner different from unsold properties).

The ratio study was based on sales data for Sullivan County provided in the standardized format, digitized sales disclosure forms, and from the MLS database from Metropolitan Indianapolis Board of Realtors (MIBOR). From all sources, the IFPI received 6,894 records of sales. Sullivan County provided parcel data via the County Assessor, including 6,460 sales records in the standardized format. Of that number, records were excluded because:

- There was no sales price;
- The sales occurred outside the date range;
- There was other needed information missing from the record;
- There were duplicate records;
- There were new construction records; and
- There were some extremes (or outliers).

This left 3.8% of the sales records to use in the equalization analysis, or a total of 265 sales records. The 265 sales represent 1.7% of the total number of parcels. Of the 265 sales, 184 are improved residential sales and 8 are improved commercial and industrial sales.

Ratio Study Methodology

The main methodological steps taken to perform the ratio study in Sullivan County were:

(1) assemble the data,
(2) determine the study groups ("strata"),
(3) make statistical analyses.

The Legislative Services Agency and Almy, Jacobs, Gloudemans, and Denne ("the consultant") cleaned the data, meaning that records with incomplete information or with data in an unusable format were eliminated from analysis unless the problems could be rectified. In addition, both the parcel and sales disclosure data were screened to determine whether a specific sale should be used in the ratio study. Reasons that a sale would be excluded include non-arm's length sales, construction on the property since the last assessment, and extreme values.[4]

Computerized statistical programming was used to match the sale with an assessment. Since sales from 1998 through 2003 were included, adjustments to reported sales prices were made to account for the difference between the sale's date and the assessment date.

[4] See the IFPI's "Background Tool Kit" July, 2004 for a more complete discussion of sales screening at http://www.indianafiscal.org/docs/BackgroundToolKit.pdf.

In accordance with 50 IAC 14-5-1, the Department of Local Government Finance's equalization standards require equalization be performed for each of the following classes of property in each Township:

- Improved Residential
- Unimproved Residential
- Improved Commercial
- Unimproved Commercial
- Improved Industrial
- Unimproved Industrial
- Agricultural Land (use value basis)

When a sample of sales is small, when it does not represent the makeup of the total assessment roll well, and when the variation in sales ratios is great, ratio study statistics may not reliably portray the quality of appraisals.

In Sullivan County, sales sample sizes were small in some townships and for some classes of property. Therefore, the consultant "re-stratified," or combined, first, some of the classes of property and, then collapsed all classes in all townships to the county-wide level. When considered necessary, the first level of re-stratification was to combine (1) improved commercial and improved industrial property into a broader commercial and industrial property stratum and (2) unimproved commercial, industrial, and residential property into a broader vacant land stratum. Then, all townships were re-stratified to the county-wide level to produce statistics with higher sample sizes for the county.

As previously noted, the IFPI used 265 sales to evaluate the assessments of 15,525 residential, commercial and industrial, and agricultural properties. We calculated standard ratio study statistics and used performance standards promulgated by the International Association of Assessing Officers (IAAO) to evaluate the results.[5] The following statistics were calculated:

- The *median ratio* was selected as the measure of central tendency used to describe the *level of assessment*—how close assessments are, overall, to 100 percent of market value. The IAAO standard is that assessments should be within 10% of market value. That means the median ratio should be between 90% and 110% (0.9 and 1.1).
- The 95% *confidence interval* around the median. The confidence interval provides an indication of the reliability of the calculated median. It measures the probability that a range of values is likely to include the median value. The width of the confidence interval at a given level of confidence (e.g., 95%) is a statement regarding the certainty of the estimate based on both the amount and variability of the sample data. Said another way, since we use a sample to estimate the median,

[5] Each of these standards, and their statistical procedures, are discussed in more detail in the "Indiana Property Tax Equalization Study Background Tool Kit." It may be obtained at http://www.indianafiscal.org/docs/BackgroundToolKit.pdf. A full discussion of the IAAO standards may be obtained in the "Standard on Ratio Studies," 1999, International Association of Assessing Officers.

we are uncertain of the actual median value of the population. A 95% confidence interval says that while we are uncertain of the true value of the median, that true median will fall within the range of values calculated as the confidence interval 95 times out of 100. The IAAO standard for medians states that the 95% confidence interval should encompass at least some part of the standard for the median (from 0.9 to 1.1).

- The *coefficient of dispersion* (COD) is a statistic that describes the uniformity or consistency of assessments by measuring the variability of the sales ratios. The higher the COD, the less uniform or consistent the assessments. The IAAO standard is that the COD should be no more than 15.0 for improved residential property and no more than 20.0 for other classes of property.
- The *price related differential* (PRD) examines the uniformity of assessments between high-value and low-value properties. In other words, the PRD is a measure of the "vertical equity" of assessments. A PRD below 1.0 indicates that lower valued properties are assessed at a lower percentage of market value than higher value properties. In other words, lower value properties have lower sales/assessment ratios. A PRD above 1.0 indicates that higher value properties are assessed at a lower percentage of market value than lower value properties. The IAAO standard is that the PRD should be between 0.98 and 1.03.

The IAAO standards include guidance on sample sizes needed to allow confidence in the statistical measures. Small sample sizes preclude definitive interpretation of some results in some classes of property within some townships and counties. However, re-stratification of related property classes (vacant land classified as commercial, industrial, and residential; or improved commercial and industrial properties, for example) has been done in most cases, which increases sample sizes. The larger sample sizes mean that statistical analysis will provide valid results, albeit for more general interpretation.

The IAAO standards state that assessment level should be uniform across property use strata and township assessment jurisdictions. The IAAO standard is that the level of assessment (the median) should not vary across townships by more than 5% from the county-wide measure. Again, sample size affects the ability to make judgments on this standard in some cases.

Finally, the IFPI analyzed whether there were differences in changes of assessment between properties that were part of the ratio study, on the one hand, and properties that did not sell recently, on the other. Systematic differences would indicate that assessors engaged in "sales chasing." We compared the percentage changes between two groups of properties: unsold properties and those properties that had been sold and had been included in the ratio calculations. Percentage changes of assessments were computed for each property, in total and with respect to both land and improvements. The differences between the two groups were analyzed by reviewing the distributions of the changes for the two groups at the township level. Summary statistics were calculated, and statistical tests were used to determine the likelihood that the observed differences would arise by

chance alone or that they reflected systematic difference in the treatment of the two groups of properties.

Disproportionate increases in sold properties were taken as potential evidence of sales chasing. When observed, such differentials were then tested for statistical significance using the Mann Whitney test.

Ratio Study Results for Sullivan County

Table 2

Standards Compliance Matrix for Sullivan County

Class: Residential Improved Sample Size: 184

Measures	IAAO Standard	County Wide Value	95% CI Overlaps Standard	Meets Standard	Does Not Meet Standard
Median Sales Ratio	.9 to 1.1	1.114	x		
Coefficient of Dispersion	< 15.0	42.54			x

Standards and Compliance – County-wide

Sullivan County did not meet the standard for the Median Sales Ratio for the class Residential Improved property, although the Median Sales Ratio's confidence interval overlapped the standard. The sample size was small enough that little confidence in the statistics for the restratified class Commercial and Industrial improved was warranted. The county did not meet the standard for uniformity of assessment embodied in the COD metric as shown in Table 2. However, 50 IAC 14-7-1 provides that if a county believes that circumstances or reasons exist why the standard was not attained which mitigate the requirement for a new reassessment, the county may appeal to the DLGF not to do a new reassessment.

The IFPI has found that many, if not most, of the counties reviewed have not met the COD standards. The reasons are several, but may be summarized to: a) this is the first ever statewide reassessment under market value standards for the state of Indiana, and b) the sample sizes are so small that it makes deriving an acceptable COD difficult. It is therefore the IFPI's judgment that a new reassessment in Sullivan County, if ordered, would not, in the absence of larger samples of market value proxies [sales information], change the result. It is our recommendation that the county immediately begin procedures to collect and electronically record sales information but that no reassessment action be required.

Standards and Compliance – Townships

The sample sizes were large enough in the improved residential class in three of the nine townships to have confidence in the township level statistics. Table 3 presents ratio study

statistics for those townships. The sample size for improved commercial & industrial property was not large enough in any township to have confidence in those statistics.

Table 3
Standards Compliance Matrix: Townships

Class: Residential Improved						
Township	**Sample Size**	**Median**	**Median Meets Standard?**	**Within +/- 5% of County?**	**Coefficient of Dispersion**	**COD Meets Standard?**
Cass	20	1.321			37.180	
Curry	39	1.060	x	x	31.240	
Hamilton	94	1.073	x	x	46.670	

The detailed results of the analysis are presented in Appendix A. Appendix A contains the summary statistics for the re-stratified sample that combined similar property classes across the entire county to increase the sample size, as well as the township by township results.

In addition to the statistical tests performed relating to the level and uniformity of assessment, the IFPI attempted to perform the tests required to determine if sales chasing was evidenced in Sullivan County. Sales chasing is indicated when the distribution of percentage changes in assessed value for properties that sold is significantly different than the distribution of percentage changes in assessed value of properties that did not sell recently. The sample size with adequate prior assessed value data was too small, so we were unable to perform sales chasing tests.

Summary Quality Evaluation of Sullivan County's Reassessment Results

Small sample sizes preclude definitive evaluation of the reassessment quality for all classes of property in all townships.

Cass Township did not meet the standard for uniformity across jurisdictions in the Residential Improved class. Those townships' median ratio varied from the county-wide median ratio by more than 5%.

For the county as a whole in the residential improved class, we find assessment quality with respect to the median sales ratio met the standard. The class did not meet the standard for the coefficient of dispersion.

Appendix A

County Data

Sullivan County Property Tax Reassessment Equalization Analysis
Indiana Property Tax Equalization Project

Standard Equalization Via Median

	MajrClas	ParclCnt	AV - Total Land & Improvements	Sample Size	Sample Parcels Pct of Popln	Sample Assessed Value Pct	Coefficient of Dispersion	Price Related Differential	Median	Lower bound of 95% confidence interval for Median	Upper bound of 95% confidence interval for Median	Imputed Market Value per Median Ratio
1	Agri-Vac	3,377	112,659,600	32	0.95	1.65	44.84	0.92	0.418	0.24	0.52	269,263,043
2	Agri-Imp	1,886	163,158,600	25	1.33	1.25	59.93	1.26	0.892	0.74	1.01	182,999,763
3	Ind-Vac	28	568,400	.	.	.	.	.	.	.	.	.
4	Ind-Imp	281	14,836,700	1	0.36	0.07	.	1.00	3.981	.	.	3,727,159
5	Coml-Vac	175	4,618,500	1	0.57	0.39	.	1.00	0.452	.	.	10,210,990
6	Coml-Imp	571	86,504,600	7	1.23	0.89	47.18	2.00	1.287	0.17	2.28	67,210,088
7	Res-Vac	2,211	8,375,100	15	0.68	5.15	70.47	1.16	0.238	0.11	0.40	35,193,114
8	Res-Imp	6,996	349,782,580	184	2.63	2.84	42.54	1.21	1.114	1.04	1.22	313,952,347
Total		**15,525**	**740,504,080**	**265**								

Restratified Equalization Via Median

	MjrCls2	ParclCnt	Asmt Total, New	Sample Size	Sample Parcels Pct of Popln	Sample Assessed Value Pct	Coefficient of Dispersion	Price Related Differential	Median	Lower bound of 95% confidence interval for Median	Upper bound of 95% confidence interval for Median	Imputed Market Value per Median Ratio
1	Agri-Vac	3,377	112,659,600	32	0.95	1.65	44.84	0.92	0.418	0.24	0.52	269,263,043
2	Agri-Imp	1,886	163,158,600	25	1.33	1.25	59.93	1.26	0.892	0.74	1.01	182,999,763
3	C+I-Vac	203	5,186,900	1	0.49	0.35	.	1.00	0.452	.	.	11,467,660
4	C+I-Imp	852	101,341,300	8	0.94	0.77	62.65	2.41	1.386	0.17	3.98	73,137,860
5	Res-Vac	2,211	8,375,100	15	0.68	5.15	70.47	1.16	0.238	0.11	0.40	35,193,114
6	Res-Imp	6,996	349,782,580	184	2.63	2.84	42.54	1.21	1.114	1.04	1.22	313,952,347
Total		**15,525**	**740,504,080**	**265**								

Restratified (2) Equalization Via Median

	MjrCls3	ParclCnt	AV - Total Land & Improvements	Sample Size	Sample Parcels Pct of Popln	Sample Assessed Value Pct	Coefficient of Dispersion	Price Related Differential	Median	Lower bound of 95% confidence interval for Median	Upper bound of 95% confidence interval for Median	Imputed Market Value per Median Ratio
1	Agri-Vac	3,377	112,659,600	32	0.95	1.65	44.84	0.92	0.418	0.24	0.52	269,263,043
2	Agri-Imp	1,886	163,158,600	25	1.33	1.25	59.93	1.26	0.892	0.74	1.01	182,999,763
3	C+I-Imp	852	101,341,300	8	0.94	0.77	62.65	2.41	1.386	0.17	3.98	73,137,860
4	C+I+R Vac	2,414	13,562,000	16	0.66	3.31	63.58	1.17	0.268	0.11	0.43	50,541,149
5	Res-Imp	6,996	349,782,580	184	2.63	2.84	42.54	1.21	1.114	1.04	1.22	313,952,347
Total		**15,525**	**740,504,080**	**265**								

Sullivan County Property Tax Reassessment Equalization Analysis
Indiana Property Tax Equalization Project

Standard Equalization Via Median

	CntyXtwp	MajrClas	ParclCnt	AV - Total Land & Improvements	Sample Size	Sample Parcels Pct of Popln	Sample Assessed Value Pct	Coefficient of Dispersion	Price Related Differential	Median	Lower bound of 95% confidence interval for Median	Upper bound of 95% confidence interval for Median	Imputed Market Value per Median Ratio
1	Cass Twp	Agri-Vac	162	3,993,100	3	1.85	4.41	43.19	0.79	0.526	0.05	0.73	7,591,642
2	Cass Twp	Agri-Imp	135	8,432,900	1	0.74	0.47	.	1.00	3.346	.	.	2,520,366
3	Cass Twp	Ind-Vac	6	61,000	.	.	.	.	.	.	.	.	.
4	Cass Twp	Ind-Imp	61	3,736,900	1	1.64	0.27	.	1.00	3.981	.	.	938,755
5	Cass Twp	Coml-Vac	21	306,900	.	.	.	.	.	.	.	.	.
6	Cass Twp	Coml-Imp	62	2,460,700	1	1.61	3.03	.	1.00	0.758	.	.	3,244,668
7	Cass Twp	Res-Vac	293	1,236,500	2	0.68	5.15	59.43	0.96	0.273	0.11	0.43	4,536,322
8	Cass Twp	Res-Imp	822	34,713,900	20	2.43	2.16	37.18	1.11	1.321	0.98	1.73	26,273,083
9	Curry Twp	Agri-Vac	318	11,380,600	.	.	.	.	.	.	.	.	.
10	Curry Twp	Agri-Imp	166	16,617,400	8	4.82	3.33	59.10	1.18	0.843	0.17	3.04	19,710,022
11	Curry Twp	Ind-Imp	10	237,500	.	.	.	.	.	.	.	.	.
12	Curry Twp	Coml-Vac	40	370,600	.	.	.	.	.	.	.	.	.
13	Curry Twp	Coml-Imp	122	9,348,300	2	1.64	5.51	76.94	3.05	0.727	0.17	1.29	12,851,775
14	Curry Twp	Res-Vac	452	1,700,300	4	0.88	5.11	78.08	1.48	0.328	0.05	1.03	5,190,327
15	Curry Twp	Res-Imp	1,492	66,999,500	39	2.61	3.42	31.24	1.17	1.060	0.90	1.28	63,211,220
16	Fairbanks Twp	Agri-Vac	394	12,311,400	2	0.51	0.89	16.78	0.96	0.378	0.31	0.44	32,601,893
17	Fairbanks Twp	Agri-Imp	152	14,046,100	2	1.32	1.01	5.16	1.00	0.962	0.91	1.01	14,594,653
18	Fairbanks Twp	Ind-Imp	1	18,100	.	.	.	.	.	.	.	.	.
19	Fairbanks Twp	Coml-Vac	6	76,000	.	.	.	.	.	.	.	.	.
20	Fairbanks Twp	Coml-Imp	10	278,200	.	.	.	.	.	.	.	.	.
21	Fairbanks Twp	Res-Vac	98	291,600	.	.	.	.	.	.	.	.	.
22	Fairbanks Twp	Res-Imp	223	11,683,100	4	1.79	1.94	39.03	1.30	1.601	0.76	2.66	7,299,537
23	Gill Twp	Agri-Vac	390	15,721,000	4	1.03	1.13	42.99	0.92	0.520	0.21	0.77	30,226,473
24	Gill Twp	Agri-Imp	189	18,959,100	.	.	.	.	.	.	.	.	.
25	Gill Twp	Ind-Imp	2	201,600	.	.	.	.	.	.	.	.	.
26	Gill Twp	Coml-Vac	1	1,400	.	.	.	.	.	.	.	.	.
27	Gill Twp	Coml-Imp	14	34,186,900	.	.	.	.	.	.	.	.	.
28	Gill Twp	Res-Vac	118	459,400	2	1.69	12.78	36.62	1.02	0.097	0.06	0.13	4,725,110
29	Gill Twp	Res-Imp	302	13,103,700	9	2.98	2.44	34.89	1.11	1.238	0.86	2.17	10,587,850
30	Haddon Twp	Agri-Vac	667	21,257,500	4	0.60	1.64	19.28	1.02	0.596	0.43	0.77	35,661,404
31	Haddon Twp	Agri-Imp	333	28,699,100	4	1.20	1.53	46.05	1.93	1.373	0.47	2.28	20,902,566
32	Haddon Twp	Ind-Imp	9	1,225,300	.	.	.	.	.	.	.	.	.
33	Haddon Twp	Coml-Vac	20	215,400	.	.	.	.	.	.	.	.	.
34	Haddon Twp	Coml-Imp	56	4,694,900	1	1.79	0.25	.	1.00	1.886	.	.	2,489,925
35	Haddon Twp	Res-Vac	197	452,300	.	.	.	.	.	.	.	.	.
36	Haddon Twp	Res-Imp	627	26,832,600	5	0.80	1.09	85.90	1.37	1.006	0.78	3.99	26,685,021

Sullivan County Property Tax Reassessment Equalization Analysis
Indiana Property Tax Equalization Project

	CntyXtwp	MajrClas	ParclCnt	AV - Total Land & Improvements	Sample Size	Sample Parcels Pct of Popln	Sample Assessed Value Pct	Coefficient of Dispersion	Price Related Differential	Median	Lower bound of 95% confidence interval for Median	Upper bound of 95% confidence interval for Median	Imputed Market Value per Median Ratio
37	Hamilton Twp	Agri-Vac	412	18,662,700	6	1.46	2.32	31.38	1.28	0.445	0.24	0.68	41,904,769
38	Hamilton Twp	Agri-Imp	262	27,450,000	5	1.91	1.28	74.87	0.98	0.804	0.09	2.28	34,122,965
39	Hamilton Twp	Ind-Vac	10	142,000	.	.	.	.	.	.	.	.	.
40	Hamilton Twp	Ind-Imp	26	4,557,600	.	.	.	.	.	.	.	.	.
41	Hamilton Twp	Coml-Vac	68	2,925,400	1	1.47	0.61	.	1.00	0.452	.	.	6,467,734
42	Hamilton Twp	Coml-Imp	262	31,825,200	3	1.15	0.53	40.59	0.93	1.484	0.48	2.28	21,443,199
43	Hamilton Twp	Res-Vac	592	2,628,700	4	0.68	5.47	32.57	0.96	0.268	0.15	0.44	9,796,307
44	Hamilton Twp	Res-Imp	2,530	150,742,380	94	3.72	3.61	46.67	1.22	1.073	0.98	1.18	140,541,521
45	Jackson Twp	Agri-Vac	322	7,846,400	5	1.55	2.00	84.96	0.84	0.151	0.11	0.50	52,053,018
46	Jackson Twp	Agri-Imp	235	18,290,900	.	.	.	.	.	.	.	.	.
47	Jackson Twp	Ind-Vac	12	365,400	.	.	.	.	.	.	.	.	.
48	Jackson Twp	Ind-Imp	48	904,700	.	.	.	.	.	.	.	.	.
49	Jackson Twp	Coml-Vac	14	607,500	.	.	.	.	.	.	.	.	.
50	Jackson Twp	Coml-Imp	31	1,528,600	.	.	.	.	.	.	.	.	.
51	Jackson Twp	Res-Vac	280	1,070,800	3	1.07	7.30	69.92	1.26	0.157	0.07	0.40	6,816,113
52	Jackson Twp	Res-Imp	634	26,799,400	10	1.58	1.51	33.12	1.17	1.333	1.05	2.06	20,102,444
53	Jefferson Twp	Agri-Vac	171	4,597,100	1	0.58	1.30	.	1.00	0.250	.	.	18,409,997
54	Jefferson Twp	Agri-Imp	145	10,541,900	.	.	.	.	.	.	.	.	.
55	Jefferson Twp	Ind-Imp	119	3,803,200	.	.	.	.	.	.	.	.	.
56	Jefferson Twp	Coml-Vac	2	8,300	.	.	.	.	.	.	.	.	.
57	Jefferson Twp	Coml-Imp	5	1,241,000	.	.	.	.	.	.	.	.	.
58	Jefferson Twp	Res-Vac	82	215,100	.	.	.	.	.	.	.	.	.
59	Jefferson Twp	Res-Imp	132	5,581,700	1	0.76	0.62	.	1.00	1.158	.	.	4,820,484
60	Turman Twp	Agri-Vac	541	16,889,800	7	1.29	2.32	131.99	0.79	0.119	0.08	0.52	142,451,511
61	Turman Twp	Agri-Imp	268	20,109,400	5	1.87	2.53	18.95	1.05	0.758	0.47	0.98	26,520,698
62	Turman Twp	Ind-Imp	4	151,800	.	.	.	.	.	.	.	.	.
63	Turman Twp	Coml-Vac	3	107,000	.	.	.	.	.	.	.	.	.
64	Turman Twp	Coml-Imp	9	940,800	.	.	.	.	.	.	.	.	.
65	Turman Twp	Res-Vac	98	318,300	.	.	.	.	.	.	.	.	.
66	Turman Twp	Res-Imp	230	13,326,300	2	0.87	1.22	20.52	0.98	0.775	0.62	0.93	17,197,541
Total			**15,518**	**740,490,180**	**265**								

Sullivan County Property Tax Reassessment Equalization Analysis
Indiana Property Tax Equalization Project

Restratified (2) Equalization Via Median

	CntyXtwp	MjrCls3	ParclCnt	AV - Total Land & Improvements	Sample Size	Sample Parcels Pct of Popln	Sample Assessed Value Pct	Coefficient of Dispersion	Price Related Differential	Median	Lower bound of 95% confidence interval for Median	Upper bound of 95% confidence interval for Median	Imputed Market Value per Median Ratio
1	Cass Twp	Agri-Vac	162	3,993,100	3	1.85	4.41	43.19	0.79	0.526	0.05	0.73	7,591,642
2	Cass Twp	Agri-Imp	135	8,432,900	1	0.74	0.47	.	1.00	3.346	.	.	2,520,366
3	Cass Twp	C+I-Imp	123	6,197,600	2	1.63	1.36	67.99	2.08	2.370	0.76	3.98	2,615,527
4	Cass Twp	C+I+R Vac	320	1,604,400	2	0.63	3.97	59.43	0.96	0.273	0.11	0.43	5,886,029
5	Cass Twp	Res-Imp	822	34,713,900	20	2.43	2.16	37.18	1.11	1.321	0.98	1.73	26,273,083
6	Curry Twp	Agri-Vac	318	11,380,600	.	.	.	.	.	.	.	.	.
7	Curry Twp	Agri-Imp	166	16,617,400	8	4.82	3.33	59.10	1.18	0.843	0.17	3.04	19,710,022
8	Curry Twp	C+I-Imp	132	9,585,800	2	1.52	5.37	76.94	3.05	0.727	0.17	1.29	13,178,283
9	Curry Twp	C+I+R Vac	492	2,070,900	4	0.81	4.20	78.08	1.48	0.328	0.05	1.03	6,321,619
10	Curry Twp	Res-Imp	1,492	66,999,500	39	2.61	3.42	31.24	1.17	1.060	0.90	1.28	63,211,220
11	Fairbanks Twp	Agri-Vac	394	12,311,400	2	0.51	0.89	16.78	0.96	0.378	0.31	0.44	32,601,893
12	Fairbanks Twp	Agri-Imp	152	14,046,100	2	1.32	1.01	5.16	1.00	0.962	0.91	1.01	14,594,653
13	Fairbanks Twp	C+I-Imp	11	296,300	.	.	.	.	.	.	.	.	.
14	Fairbanks Twp	C+I+R Vac	104	367,600	.	.	.	.	.	.	.	.	.
15	Fairbanks Twp	Res-Imp	223	11,683,100	4	1.79	1.94	39.03	1.30	1.601	0.76	2.66	7,299,537
16	Gill Twp	Agri-Vac	390	15,721,000	4	1.03	1.13	42.99	0.92	0.520	0.21	0.77	30,226,473
17	Gill Twp	Agri-Imp	189	18,959,100	.	.	.	.	.	.	.	.	.
18	Gill Twp	C+I-Imp	16	34,388,500	.	.	.	.	.	.	.	.	.
19	Gill Twp	C+I+R Vac	119	460,800	2	1.68	12.74	36.62	1.02	0.097	0.06	0.13	4,739,510
20	Gill Twp	Res-Imp	302	13,103,700	9	2.98	2.44	34.89	1.11	1.238	0.86	2.17	10,587,850
21	Haddon Twp	Agri-Vac	667	21,257,500	4	0.60	1.64	19.28	1.02	0.596	0.43	0.77	35,661,404
22	Haddon Twp	Agri-Imp	333	28,699,100	4	1.20	1.53	46.05	1.93	1.373	0.47	2.28	20,902,566
23	Haddon Twp	C+I-Imp	65	5,920,200	1	1.54	0.20	.	1.00	1.886	.	.	3,139,758
24	Haddon Twp	C+I+R Vac	217	667,700	.	.	.	.	.	.	.	.	.
25	Haddon Twp	Res-Imp	627	26,832,600	5	0.80	1.09	85.90	1.37	1.006	0.78	3.99	26,685,021
26	Hamilton Twp	Agri-Vac	412	18,662,700	6	1.46	2.32	31.38	1.28	0.445	0.24	0.68	41,904,769
27	Hamilton Twp	Agri-Imp	262	27,450,000	5	1.91	1.28	74.87	0.98	0.804	0.09	2.28	34,122,965
28	Hamilton Twp	C+I-Imp	288	36,382,800	3	1.04	0.46	40.59	0.93	1.484	0.48	2.28	24,514,021
29	Hamilton Twp	C+I+R Vac	670	5,696,100	5	0.75	2.84	33.69	1.01	0.299	0.15	0.45	19,069,886
30	Hamilton Twp	Res-Imp	2,530	150,742,380	94	3.72	3.61	46.67	1.22	1.073	0.98	1.18	140,541,521
31	Jackson Twp	Agri-Vac	322	7,846,400	5	1.55	2.00	84.96	0.84	0.151	0.11	0.50	52,053,018
32	Jackson Twp	Agri-Imp	235	18,290,900	.	.	.	.	.	.	.	.	.
33	Jackson Twp	C+I-Imp	79	2,433,300	.	.	.	.	.	.	.	.	.
34	Jackson Twp	C+I+R Vac	306	2,043,700	3	0.98	3.83	69.92	1.26	0.157	0.07	0.40	13,009,050
35	Jackson Twp	Res-Imp	634	26,799,400	10	1.58	1.51	33.12	1.17	1.333	1.05	2.06	20,102,444
36	Jefferson Twp	Agri-Vac	171	4,597,100	1	0.58	1.30	.	1.00	0.250	.	.	18,409,997

Sullivan County Property Tax Reassessment Equalization Analysis
Indiana Property Tax Equalization Project

	CntyXtwp	MjrCls3	ParclCnt	AV - Total Land & Improvements	Sample Size	Sample Parcels Pct of Popln	Sample Assessed Value Pct	Coefficient of Dispersion	Price Related Differential	Median	Lower bound of 95% confidence interval for Median	Upper bound of 95% confidence interval for Median	Imputed Market Value per Median Ratio
37	Jefferson Twp	Agri-Imp	145	10,541,900	.	.	.	.	.	.	.	.	.
38	Jefferson Twp	C+I-Imp	124	5,044,200	.	.	.	.	.	.	.	.	.
39	Jefferson Twp	C+I+R Vac	84	223,400	.	.	.	.	.	.	.	.	.
40	Jefferson Twp	Res-Imp	132	5,581,700	1	0.76	0.62	.	1.00	1.158	.	.	4,820,484
41	Turman Twp	Agri-Vac	541	16,889,800	7	1.29	2.32	131.99	0.79	0.119	0.08	0.52	142,451,511
42	Turman Twp	Agri-Imp	268	20,109,400	5	1.87	2.53	18.95	1.05	0.758	0.47	0.98	26,520,698
43	Turman Twp	C+I-Imp	13	1,092,600	.	.	.	.	.	.	.	.	.
44	Turman Twp	C+I+R Vac	101	425,300	.	.	.	.	.	.	.	.	.
45	Turman Twp	Res-Imp	230	13,326,300	2	0.87	1.22	20.52	0.98	0.775	0.62	0.93	17,197,541
Total			**15,518**	**740,490,180**	**265**								

Indiana Property Tax Equalization Study
Appendix B:
Background Tool Kit

Introduction

The State of Indiana is completing a mass reassessment of all real property in accordance with the requirements of the Indiana Supreme Court set forth in the decision in State Board of Tax Commissioners v. Town of St. John and subsequent order of the Indiana Tax Court.

The Indiana Department of Local Government Finance (DLGF) laid out the reassessment rules and procedures in Indiana Administrative Code 50 IAC. The regulations require the reassessment to produce assessments that comply with the Supreme Court Decision and the Tax Court order; specifically, that they be "objectively verifiable." Market value is the objectively verifiable standard which the reassessment must meet.

In addition, Indiana statute (I.C. 6-1.1-34) requires a School Assessment Ratio Study and the DLGF regulations require a state-wide, county-by-county report on both the processes used for and the results of the reassessment. Finally, the State needs a dynamic, accurate, consistent database for effective, ongoing property tax administration.

Therefore, the DLGF and the State Budget Agency have asked the Indiana Fiscal Policy Institute (IFPI) to perform a Property Tax Equalization Study that will provide the State with a determination of the strengths, weaknesses, and accuracy of the reassessment process and its results. The key features of the study are:

- A county-by-county analysis of the property tax equalization performed by the counties,
- A school assessment sales ratio study,
- An analysis, by jurisdiction, of the tax burden shift between classes of property,
- An analysis, by jurisdiction, of tax bill changes and property class,
- A study of the assessment methodology and process, with recommendations for improvements in future years,

- An analysis, by jurisdiction, of the effects on tax bills of levy increases, and
- An analysis of the data requirements for future property tax reassessments.

This Toolkit provides background material for local government officials, members of the media, and taxpayers to assist in their understanding of the objectives of the study and the process the IFPI used to conduct it. It includes an explanation of the need for the study, discussion of property tax administration and analysis concepts, and definitions of terms.

Why is an independent ratio study needed?

First, the Indiana Constitution requires that property tax "assessment and taxation" be "uniform and equal." It is the State's constitutional responsibility to administer the property tax system such that local governments perform the ministerial duties of assessment and tax collection in accordance with state law. In State Board of Tax Commissioners v. Town of St. John, the Supreme Court mandated a market value based assessment standard.

Therefore, the State's responsibility is to ensure compliance, by the local assessors, of the DLGF's reassessment rule. Since the Supreme Court mandated that assessments be objectively verifiable, an independent study that measures the relationship between assessments and market value is required to determine compliance by the local assessors. The best method to make that determination is an independent ratio study.

Second, a ratio study essentially is an audit of the quality of an assessment. A cursory review of county equalization studies revealed several things that called into question their general reliability. The following problems were noted:

- There were variations in study methods, and some studies used non-standard statistics.[i]
- There seemingly are discrepancies in the numbers of properties in the various mandated strata.[ii]
- There were discrepancies in the numbers of sales considered usable in the studies.

- At least as furnished by the state, most studies were poorly documented.
- Most important, the reported statistics too often were incredibly good, which lowered confidence in the county studies.

Background, Definitions, and Explanation of Concepts

Taxation is integral to civil society, and public finance experts usually recommend property taxes to bring diversity to, and help balance, a state and local revenue system. When public revenues come from several types of taxes and other sources of revenue, it is easier to find a balance among competing policy objectives, weather economic difficulties, and compete effectively in the global economy. A tax on the current market value of real property is an important part of such a system, because a market value-based property tax has a comparatively stable and reliable base, which is attractive during troubled economic times (see the box on the next page for a discussion of market value in the Indiana property tax system).

Property value can be a measure of a taxpayer's wealth or ability to pay. A real property tax is an especially suitable source of revenue for local governments. The immovability of the tax base makes clear which government is entitled to the tax revenue. If the property is security for the tax, it cannot be evaded. In addition, many local government services are provided to properties or to their owners and occupants. The tax captures for local government some of the increases in the value of land that are partially created by public expenditures, such as streets and highways, water and sewer, public safety, etc. Further, a dedicated source of revenue promotes local autonomy. Finally, the visibility of property taxes focuses attention on the overall quality of governance and promotes accountability.

What is market value?

There are many legal and textbook definitions of market value. In valuation theory however, *market value* essentially is an *expected price*—the price for a property that the seller and an unrelated buyer would most likely agree to in an open market. The definition of market value also carries the assumption that both parties were reasonably well informed about how the property could be used in the future and about prices for similar properties.

Furthermore, it would be assumed that neither was under any unusual pressure to buy or sell.

How is market value for property tax purposes determined?

Valuation or *appraisal* is the activity of *estimating* what property values are. In essence, part of the job of an appraiser is to look at properties the way typical buyers and sellers would. Although many methods may be used to estimate market values, professional appraisers have agreed to standard procedures and methods (discussed below), which require them to work systematically, document their work, and communicate their opinions of value clearly. *Assessment* is the act of officially determining the value estimate to be used as the basis for taxation; the specialist appraiser who has the responsibility for making these determinations is an *assessor*.

Real estate markets reflect the ways people who want to buy or sell real estate think and act. Tracts of land may be used for such purposes as quiet enjoyment, agriculture, exploitation of mineral resources, and development either immediately or eventually. Developed land (land with buildings and other structures) may be used for housing or for carrying out economic activities. A person may want to own real estate to use it for such purposes directly or to rent it to others. One reason for owning real estate is to receive the rental income it can generate. Another reason to own real estate is the hope that it will appreciate in value. Of course, real estate may be held for more than one purpose. The important point is that the real estate market naturally is segmented, and an important valuation activity is deciding how to best estimate its market value.

Indiana's property tax assessment standard: True tax value

The meaning of "true tax value" seems subject to interpretation. A common interpretation is that it is "market value in use." For properties whose future use would be the same as the current use, market value and true tax value is the same thing. When the future use would be different from the current use, true tax value can be inferred from the market value of similar properties whose use is unlikely to change or that are not subject to the same economic pressures, whether positive or negative. Indiana courts have ruled that true tax values must be "objectively verifiable"—hence the need for the tax equalization study.

In appraisal practice, there are three basic "approaches" to estimating market values. These reflect market participants' behaviors and the resulting evidence of market values.

- The *sales comparison approach:* Gathers information on recent open-market sales prices of similar properties[iii], analyzes why their prices differ, and uses that information to estimate the value of each appraisal property[iv]. It provides the best way to appraise residences and vacant land plots.

- The *income approach:* Uses the estimated future income stream over the remaining economic life of a property and uses a rate-of-return on investments of comparable risk to "capitalize" the income stream into a present value as of the appraisal date. It provides an excellent way to appraise properties that commonly are rented.

- The *cost approach:* Combines three components: the replacement cost of improvements *minus* accrued depreciation *plus* land value, which are separately estimated. Replacement cost is what it would cost to replace the existing structures and other improvements with new construction. Accrued depreciation is the loss in value due to physical depreciation, functional obsolescence, and economic obsolescence. Land value is what vacant land with the same characteristics and allowable uses would sell for in the open market[v].

Appraisal standards recommend using as many of the approaches as is practical. Theoretically, all three approaches would yield the same estimate of value. However, market imperfections, data limitations, differences in appraisal skills, and other factors conspire to produce differing value estimates in practice. Consequently, appraisers must evaluate the strengths and weaknesses of the above approaches and chose the figure that is most appropriate in the circumstances. This process is known as "reconciliation".

Although the summary above has not provided the details, all three approaches to value require analysis of available sales of comparable properties. This requires assessors to collect information on sales of real estate in their jurisdictions (and desirably to consider comparable sales from other areas as well). Each sale should be evaluated (or screened) to determine whether it is usable in appraisal (that is, meets the criteria of an open-market, arm's-length sale) and whether it is usable in ratio studies (discussed below). To help with this process, Indiana law requires buyers and sellers to complete a sales disclosure form.

> ***Mass appraisal in Indiana***
>
> The 2002 Real Property Assessment Manual, which Indiana township and county assessors are required to use, lays out a framework for a mass appraisal system. System specifications reinforce it. The cost approach is the default valuation approach.

The *purpose* of an appraisal greatly affects how the appraisal should be conducted. Two factors especially affect appraisals for property tax purposes: (1) the need for efficiency in the appraisal process and (2) the need to treat taxpayers consistently. Efficiency is warranted because the costs of administering a tax should be kept to a minimum.[vi] Relative to most other purposes for commissioning an appraisal (such as determining the price of a property or whether the property provides sufficient collateral for a mortgage), the amounts at stake in a property tax appraisal (the taxes in question) are low. Consistency is warranted for the intended goal of equity and for quality assurance. So-called "mass appraisal" methods serve both goals. As defined by the International Association of Assessing Officers, mass appraisal is "the process of valuing a group of properties as of a given date, using standard methods, employing common data, and allowing for statistical testing." Modern mass appraisal relies considerably on computer support.

What does "equalization" mean and why is it needed?

"Equalization" is a loosely used term in property tax administration. Formally, equalization is used to describe processes by which an agency with authority over two or more assessment districts (like the Indiana Department of Local Government Finance) makes adjustments to total assessments in the districts so that the assessments within the agency's jurisdiction all bear the same relationship to total market value.

Informally, property tax officials may use "equalization" as a synonym for reassessment, review of assessments, or deciding assessment appeals. Equalization, as defined above, also is known as *inter*-jurisdictional equalization. Sometimes equalization agencies have authority to adjust total assessments of classes of property within an assessment district; this is known as *intra*-jurisdictional equalization.

Equalization programs sometimes are classified as "direct" or "indirect," although the distinction may be blurred in certain instances. In direct equalization, by application of an equalization factor or reassessment order,

the equalization agency causes local assessments to be changed. In indirect equalization, neither local assessments nor local taxes are affected; the equalized value estimates merely figure in aid distribution formulas and the like.

States "equalize" property tax assessments for three main reasons:

- To ensure that local governments comply with the law – that is, to ensure equitable treatment of taxpayers under the law.
- To ensure that taxpayers benefit equally from state-mandated exemptions.
- To improve the allocation of state aid.

In order to have a rational basis for equalization, measurement of the quality of property tax assessments must be performed. Ratio studies provide that rational measurement by analyzing property tax assessments.

What is a "ratio study"?

Here we consider only basic concepts; later we consider some of the issues involved. A "ratio study" is an investigation of how closely the *appraisals* that underlie property tax assessments approach *market values* and how consistent those appraisals are across all property. As will be illustrated through an example later, there are two principal concerns:

1. Level – Do the assessments meet the State's standard? In other words: on average, how close are the assessments to market value?
2. Uniformity or Consistency – How close are individual assessment ratios to assessment ratios across all property?

A ratio study is a form of applied statistical analysis. This means that conclusions are drawn about the overall *quality of assessments* on the basis of data about a sample of properties—those that happen to have sold on the open market. For those

Two views of statistics

"There are three kinds of lies: Lies, damned lies, and statistics."

Benjamin Disraeli (1804-1881)

"Statistics is a body of methods for making wise decisions in the face of uncertainty."

W. Allen Roberts and Harry V. Roberts, *Statistics: A New Approach*, 1956

conclusions to be valid, certain conditions need to be met. This also means that uncertainty cannot be completely dispelled. Judgment always is needed in interpreting the results of a ratio study.

What are the steps in completing a ratio study?

The main steps in a ratio study are: (1) assemble the data, (2) determine the study groups ("strata"), (3) make statistical analyses, (4) evaluate results, and (5) report the results.
Data assembly - the most labor-intensive phase of a ratio study - requires:

1. Collecting raw sales data—in Indiana the primary source of sales data is the sales disclosure form that buyers must file. Other sources may be used.

    - Key data are computerized; quality checks are made.

    - Screening the sales to determine whether a particular sale should be used in the ratio study—recall that only open-market, arm's-length sales provide reliable evidence of market values. Family sales, foreclosure sales, and the like often do not. In addition, sales that would produce extremely high or low sales ratios are excluded. These are called "outliers."

    - Matching the sale price with an assessment. In doing this, it is important to determine whether the property that was sold essentially is the same as the property that was assessed. A sale can take place any day of the year, while assessments are as of a single date. If significant physical changes to a property took place between the two dates, the sale cannot be used to evaluate the quality of the assessor's appraisal.

    - Making necessary adjustments to reported sales prices. Sometimes adjustments to actual sales prices are warranted to make the evaluation of assessments fairer. For example: If a sale included significant personal property that was not considered in the real property assessment, the estimated value of the personal property inflates the price above market value. Such distortions should be removed. After these steps have been completed, the sales file is ready for analysis.

2. *Stratification*. Recalling that the real estate market is naturally segmented and that different methods may be used to appraise different types of property, a better picture of assessment performance can be obtained if different subsets of property are studied separately. This is called "stratification." Common subsets ("strata") are the main types of property—residential, commercial, industrial, agricultural, and vacant land. In equalization, different taxing districts may be studied separately.

3. *Data analysis*. After data assembly and stratification, analysis can begin. The next section discusses and illustrates the main statistical computations using a fictitious data set.

4. *Evaluation of results*. When a sample of sales is small, when it does not represent the total makeup of the total assessment roll well, and when the variation in sales ratios is great, ratio study statistics may not reliably portray the quality of appraisals. The same is true if appraisals of parcels in the ratio study sample are adjusted so that they approximate sales prices (so-called "sales chasing"), with the result being ratio study statistics that imply quality appraisals. Another method of misrepresenting the quality of appraisals is to select for inclusion in the sample only sales with "good" ratios ("cherry picking"). Analysts should consider such possibilities before drawing conclusions based on ratio study statistics about the quality of appraisals.

5. *Reporting*. The final step in a ratio study is to report the results. What is reported will depend on the purpose of the study and the audience. More detail is required when the audience includes non-specialists. It often is helpful to compare observed performance with standards of performance, such as those promulgated by the International Association of Assessing Officers.

How are ratio-study statistics calculated and what do they mean?

When actual sales are used as evidence of market values, the investigation is known as a "sales ratio study." A sales ratio (R) is formed by dividing the appraised value (A) by the sales price (S). For example, if a property was appraised for $148,000 and it was sold for $154,000, the sales ratio would be:

$$R = A / S = 148{,}000 / 154{,}000 = 0.961.$$

That is, the appraisal is 96 percent of the sale price. In a ratio study, sales ratios would be calculated for all the sales that were deemed usable and patterns in the ratios would be examined.

Table 1: Data used to illustrate calculation of basic ratio study statistics

Sample sales data to illustrate the calculation of ratio study statistics

The adjoining nine sales will be used to show how ratio study statistics are calculated. They have been randomly selected from a data set of 75 sales that has been concocted to illustrate both calculations and points.

ID No.	Assessment	Sale Price	Ratio
(1)	(2)	(3)	(4)
61	99,200	772,000	0.128
3	28,000	59,250	0.473
16	54,110	99,000	0.547
20	36,320	63,300	0.574
27	**50,560**	**70,500**	**0.717**
29	61,360	78,000	0.787
33	58,080	69,000	0.842
68	182,000	153,000	1.190
57	160,000	129,600	1.235
Total	729,630	1,493,650	6.493

The statistics calculated in ratio studies mainly deal with the *level* of value (assessment) and the *uniformity* of values as previously noted. Another area of statistical inquiry is whether the primary statistics described below may be considered *reliable.* Level of value is measured by a *measure of central tendency,* such as the *median,* the common *arithmetic mean,* and the *weighted mean.* There are several aspects to uniformity. If the question is whether two or more groups of property are valued uniformly, measures of central tendency are compared. If the question is whether all the properties *in* a group are valued uniformly, a *measure of variability* is calculated. The *coefficient of dispersion* is the chief measure used. Sometimes, the concern is whether high-value properties and low-value properties are valued uniformly. The *price-related differential* is used here.

- *Median*—the median ratio is the *middle* sales ratio when the ratios are arrayed in order of magnitude. When the total number of sales is even, the median is the arithmetic mean of the two middle-most ratios. In table 1, the sales ratios in column 4 have already been arrayed from lowest (0.128) to highest (1.235). The middle ratio (the median) is that of the fifth sale (ID no. 27), which is 0.717. If the sale with ID

no. 57 were not in the sample, the median would be the average of the ratios of sales 20 and 27, which would be 0.646 ([0.574+0.717]/2). The value of the median is unaffected by the values of the ends of the array. For this reason, the median generally is the preferred measure of central tendency when evaluating the quality of a reassessment.

- *Arithmetic mean*—the arithmetic mean is the sum of the individual ratios divided by the number of ratios. If the nine ratios in table 1 were added, they would total 6.493, the average of which would be 0.721. Although not evident from this small sample of nine sales, the value of the mean is strongly affected by the values of the extreme ratios. Hence, it is not relied upon in sales ratio studies.

- *Weighted mean*—the weighted mean ratio is the sum of the appraisals (assessments) divided by the sum of the sales prices. In table 1, the sum of appraised values (column 2) is 729,630, and the sum of the sales prices (column 3) is 1,493,650. Dividing 729,630 by 1,493,650 results in a ratio of 0.488. As inspection of table 1 would reveal, this ratio is heavily influenced by sale 61, which sold for $772,000. This dollar-weighting feature makes the weighted mean the preferred measure of central tendency when the objective is to estimate to total market value of a district (as in indirect equalization).

- *Coefficient of dispersion*—the coefficient of dispersion (COD) measures the average percentage deviation of individual ratios from the median ratio. The lower the COD, the more uniform the appraisals. Table 2 (below), which is derived from table 1, illustrates the calculations.

  1. subtracting the median from each ratio (result in column 3),

  2. taking the absolute value (negative signs are ignored) of the differences (result in column 4),

  3. summing these values (result = 2.332),

  4. dividing by the number of ratios to obtain the “average absolute deviation” (2.332 / 9 = 0.259),

5. dividing by the median (0.259 / 0.717 = 0.361, and
6. multiplying by 100 to express the results in percentage terms (result = 36.1%).

Table 2: Calculation of the coefficient of dispersion (COD)

ID No. (1)	Ratio (2)	Ratio-Median (3)	Absolute Value (4)
61	0.128	-0.589	0.589
3	0.473	-0.245	0.245
16	0.547	-0.171	0.171
20	0.574	-0.143	0.143
27	0.717	0.000	0.000
29	0.787	0.070	0.070
33	0.842	0.125	0.125
68	1.190	0.472	0.472
57	1.235	0.517	.0517
		Sum =	2.332

Average Absolute Deviation:	2.332 / 9	=	0.259
Coefficient of Dispersion:	0.259 / 0.717	=	0.361
COD expressed as percentage:	0.361 * 100	=	36.1%

- *Price-related differential*—the price-related differential (PRD) is the mean ratio divided by the weighted mean ratio. The PRD of the nine ratios in table 1 is 1.477 (0.721/0.488). PRDs close to 1.0 signify uniform appraisals. If the PRD is much above 1.0 (as is the case here), high-value properties tend to be valued at a lower percentage of value than low-value properties. This is known as "assessment regressivity." PRDs much below 1.0 signify "progressivity."

Endnotes

[i] Computational errors also were noted.

[ii] Some studies provided no information on the numbers of properties in each stratum making it impossible to determine whether omitted strata should have been studied.

[iii] Referred to as "comparables."

[iv] also known as the "subject property."

[v] Although it is the least direct approach, the cost approach often is the default valuation approach because it was the first mass appraisal approach to be developed and because data on replacement costs are inexpensively available from specialist publishers.

[vi] Adam Smith's fourth canon of taxation states "Every tax ought to be so contrived as both to take out and keep out of the pockets of the people as little as possible, over and above what it brings into the public treasury of the state" (*Wealth of Nations*, 1776).

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