

Indiana Property Tax Equalization Study

Hendricks County Equalization Report



July 20, 2005

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County Report for Hendricks County

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This document summarizes the data, the equalization statistics, and the results of the Ratio Study performed on Hendricks County. The first section of this document entails specific results for Hendricks 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 Hendricks County.

County Overview

Hendricks County is bordered by Putnam, Montgomery, Boone, Marion and Morgan Counties in Central Indiana. Plainfield is the largest city (population 22,564), and Danville is the county seat. Hendricks County's population is 123,476 (2003),¹ ranking it 12th in population. There are 12 townships in Hendricks County: Brown, Center, Clay, Eel River, Franklin, Guilford, Liberty, Lincoln, Marion, Middle, Union and Washington Townships.

Hendricks County completed its March 1, 2002 reassessment on March 21, 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, Hendricks County

Real Property in Hendricks County	Residential	Commercial & Industrial	Agricultural	Total
Number of Parcels	37,351	10,666	3,346	51,363
Assessed Value	\$5,090,850,600	\$1,381,974,210	\$136,469,700	\$6,609,294,510

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

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

- (2) transmit the data with respect to the assessment date of each 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 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.

² HEA 1499 - 2001, Section 16.

³ HEA 1499 - 2001, Section 15.

For Hendricks County, the IFPI evaluated the accuracy of the assessment of 51,363 parcels of residential, commercial and industrial, and agricultural property (see Table 1). This 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 Hendricks 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 7,896 records of sales. Hendricks County provided parcel data via the County Assessor. 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 43.9% of the sales records to use in the equalization analysis, or a total of 3,466 sales records. The 3,466 sales represent 6.7% of the total number of parcels. Of the 3,466 sales, 3,373 are improved residential sales and 80 are improved commercial and industrial sales.

Ratio Study Methodology

The main methodological steps taken to perform the ratio study in Hendricks 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 Hendricks 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 3,466 sales to evaluate the assessments of 51,363 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

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.

the sample data. Said another way, since we use a sample to estimate the median, 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 Hendricks County

Table 2					
Standards Compliance Matrix for Hendricks County					
Class: Residential Improved Sample Size: 3,373					
Measures	IAAO Standard	County Wide Value	95% CI Overlaps Standard	Meets Standard	Does Not Meet Standard
Median Sales Ratio	.9 to 1.1	0.961		x	
Coefficient of Dispersion	< 15.0	11.18		x	
Class: Commercial & Industrial Improved Sample Size: 80					
Measures	IAAO Standard	County Wide Value	95% CI Overlaps Standard	Meets Standard	Does Not Meet Standard
Median Sales Ratio	.9 to 1.1	0.799			x
Coefficient of Dispersion	< 20.0	25.29			x

Standards and Compliance – County-wide

Hendricks County met the standards for the Median Sales Ratio and the COD metric for the class Residential Improved property. The county did not meet either standard for the class Commercial and Industrial Improved property, 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 Hendricks 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 11 of the townships in the improved residential class to have confidence in those statistics. The sample sizes for improved commercial & industrial property were large enough in one township to have confidence in those statistics. Table 3 presents ratio study statistics for those townships.

Table 3						
Standards Compliance Matrix: Townships						
Class: Residential Improved						
Twp	Sample Size	Median	Median Meets Standard?	Within +/- 5% of County?	Coefficient of Dispersion	COD Meets Standard?
Brown Twp	324	0.958	x	x	10.35	x
Center Twp	291	0.982	x	x	13.48	x
Clay Twp	47	0.970	x	x	19.73	
Eel River Twp	29	0.931	x	x	19.12	
Guilford Twp	704	0.949	x	x	12.13	x
Liberty Twp	124	0.945	x	x	13.81	x
Lincoln Twp	761	0.959	x	x	10.32	x
Marion Twp	27	0.862			14.87	x
Middle Twp	123	0.899	x		11.18	x
Union Twp	43	0.950	x	x	20.20	
Washington Twp	881	0.974	x	x	8.66	x
Class: Commercial & Industrial Improved						
Twp	Sample Size	Median	Median Meets Standard?	Within +/- 5% of County?	Coefficient of Dispersion	COD Meets Standard?
Harrison Twp	20	0.804		x	26.52	

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 Hendricks 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. This test was performed and the results are shown in Table 4.

Table 4				
Sales Chasing Analysis Results for Hendricks County				
("x" indicates statistical evidence of systematic difference between sold and unsold parcels)				
		Percent Change in Assessments of Land, Improvements, and Total		
Twp		Land	Improvements	Total
Clay Twp		x		
Eel River Twp		x		
Franklin Twp		x		
Marion Twp		x		
Middle Twp		x		

Evidence of sales chasing was found in Clay, Eel River, Franklin, Marion and Middle Townships.

Summary Quality Evaluation of Hendricks County’s Reassessment Results

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

For the townships with adequate sample sizes in improved residential property, we found all but Marion met acceptable standards of assessment quality. Marion and Middle Townships did not meet the standard for uniformity across jurisdictions in the Residential Improved class. These townships' median ratio varied from the county-wide median ratio by more than 5%.

For the township with adequate sample sizes in commercial and industrial improved property, we found it did not meet acceptable standards of assessment quality, but the ratio was within 5% of the county-wide median ratio.

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

Evidence for sales chasing was found in five townships in Hendricks County.

Overall, we find Hendricks County met an acceptable standard of quality of assessment with respect to the level of assessment for residential property.

Appendix A

County Data

Hendricks 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	2,868	105,073,300	.	.	.	.	.	.	.	.	.
2	Agri-Imp	478	31,396,400	.	.	.	.	.	.	.	.	.
3	Ind-Vac	38	2,865,470	2	5	1.49	10.23	1.06	1.035	0.93	1.14	2,767,908
4	Ind-Imp	206	446,265,010	8	4	4.07	23.96	1.03	0.933	0.53	1.35	478,566,210
5	Coml-Vac	495	27,254,130	3	1	4.73	6.63	0.94	1.074	0.89	1.10	25,377,911
6	Coml-Imp	1,677	812,194,630	72	4	3.34	24.87	1.02	0.789	0.74	0.83	1,029,417,370
7	Res-Vac	8,250	93,394,970	8	0	0.87	17.02	0.96	0.939	0.62	1.24	99,503,284
8	Res-Imp	37,351	5,090,850,600	3,373	9	9.20	11.18	1.01	0.961	0.96	0.96	5,299,355,794
Total		51,363	6,609,294,510	3,466								

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	2,868	105,073,300	.	.	.	.	.	.	.	.	.
2	Agri-Imp	478	31,396,400	.	.	.	.	.	.	.	.	.
3	C+I-Vac	533	30,119,600	5	1	4.42	7.92	0.95	1.074	0.89	1.14	28,046,117
4	C+I-Imp	1,883	1,258,459,640	80	4	3.60	25.29	0.98	0.799	0.75	0.84	1,574,739,890
5	Res-Vac	8,250	93,394,970	8	0	0.87	17.02	0.96	0.939	0.62	1.24	99,503,284
6	Res-Imp	37,351	5,090,850,600	3,373	9	9.20	11.18	1.01	0.961	0.96	0.96	5,299,355,794
Total		51,363	6,609,294,510	3,466								

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	2,868	105,073,300	.	.	.	.	.	.	.	.	.
2	Agri-Imp	478	31,396,400	.	.	.	.	.	.	.	.	.
3	C+I-Imp	1,883	1,258,459,640	80	4	3.60	25.29	0.98	0.799	0.75	0.84	1,574,739,890
4	C+I+R Vac	8,783	123,514,570	13	0	1.73	14.81	0.93	0.949	0.81	1.14	130,112,571
5	Res-Imp	37,351	5,090,850,600	3,373	9	9.20	11.18	1.01	0.961	0.96	0.96	5,299,355,794
Total		51,363	6,609,294,510	3,466								

Hendricks 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 Brown Twp	Agri-Vac	199	6,862,100	.	.	.	.	.	.	.	.	.
2 Brown Twp	Agri-Imp	28	2,548,000	.	.	.	.	.	.	.	.	.
3 Brown Twp	Ind-Vac	1	15,300	.	.	.	.	.	.	.	.	.
4 Brown Twp	Ind-Imp	5	6,728,800	.	.	.	.	.	.	.	.	.
5 Brown Twp	Coml-Vac	18	1,364,600	.	.	.	.	.	.	.	.	.
6 Brown Twp	Coml-Imp	52	41,416,600	3	5.77	5.66	34.62	1.06	0.904	0.64	1.58	45,795,448
7 Brown Twp	Res-Vac	611	11,093,900	.	.	.	.	.	.	.	.	.
8 Brown Twp	Res-Imp	2,932	524,526,000	324	11.05	10.70	10.35	1.02	0.958	0.94	0.97	547,559,799
9 Center Twp	Agri-Vac	288	10,858,300	.	.	.	.	.	.	.	.	.
10 Center Twp	Agri-Imp	49	3,194,700	.	.	.	.	.	.	.	.	.
11 Center Twp	Ind-Vac	6	15,300	.	.	.	.	.	.	.	.	.
12 Center Twp	Ind-Imp	46	14,147,340	1	2.17	8.01	.	1.00	1.328	.	.	10,652,546
13 Center Twp	Coml-Vac	30	236,720	.	.	.	.	.	.	.	.	.
14 Center Twp	Coml-Imp	254	69,383,640	13	5.12	2.40	26.54	1.06	0.817	0.59	1.04	84,907,156
15 Center Twp	Res-Vac	890	9,984,800	3	0.34	1.75	27.35	0.92	0.723	0.62	1.21	13,813,587
16 Center Twp	Res-Imp	3,322	447,622,600	291	8.76	8.50	13.48	1.01	0.982	0.97	1.00	456,046,133
17 Clay Twp	Agri-Vac	211	7,746,200	.	.	.	.	.	.	.	.	.
18 Clay Twp	Agri-Imp	40	1,922,300	.	.	.	.	.	.	.	.	.
19 Clay Twp	Ind-Vac	2	12,800	1	50.00	78.05	.	1.00	1.141	.	.	11,217
20 Clay Twp	Ind-Imp	8	1,408,800	1	12.50	1.21	.	1.00	1.350	.	.	1,043,223
21 Clay Twp	Coml-Vac	14	123,700	.	.	.	.	.	.	.	.	.
22 Clay Twp	Coml-Imp	45	2,359,500	1	2.22	1.65	.	1.00	0.556	.	.	4,244,817
23 Clay Twp	Res-Vac	326	2,952,200	.	.	.	.	.	.	.	.	.
24 Clay Twp	Res-Imp	838	87,675,300	47	5.61	5.60	19.73	0.97	0.970	0.82	1.04	90,419,514
25 Eel River Twp	Agri-Vac	388	13,733,700	.	.	.	.	.	.	.	.	.
26 Eel River Twp	Agri-Imp	58	3,891,900	.	.	.	.	.	.	.	.	.
27 Eel River Twp	Ind-Vac	1	8,400	.	.	.	.	.	.	.	.	.
28 Eel River Twp	Ind-Imp	5	262,700	.	.	.	.	.	.	.	.	.
29 Eel River Twp	Coml-Vac	19	279,900	.	.	.	.	.	.	.	.	.
30 Eel River Twp	Coml-Imp	47	3,005,900	.	.	.	.	.	.	.	.	.
31 Eel River Twp	Res-Vac	219	3,474,600	.	.	.	.	.	.	.	.	.
32 Eel River Twp	Res-Imp	654	79,072,900	29	4.43	5.41	19.12	1.04	0.931	0.73	1.02	84,959,393
33 Franklin Twp	Agri-Vac	255	9,334,600	.	.	.	.	.	.	.	.	.
34 Franklin Twp	Agri-Imp	43	2,939,700	.	.	.	.	.	.	.	.	.
35 Franklin Twp	Ind-Imp	2	34,800	.	.	.	.	.	.	.	.	.
36 Franklin Twp	Coml-Vac	3	10,300	.	.	.	.	.	.	.	.	.
37 Franklin Twp	Coml-Imp	25	2,271,300	1	4.00	11.95	.	1.00	1.209	.	.	1,878,443
38 Franklin Twp	Res-Vac	191	2,183,400	.	.	.	.	.	.	.	.	.
39 Franklin Twp	Res-Imp	500	57,350,300	19	3.80	4.67	12.76	1.03	0.964	0.88	1.05	59,508,645
40 Guilford Twp	Agri-Vac	136	4,369,800	.	.	.	.	.	.	.	.	.

**Hendricks County Property Tax Reassessment Equalization Analysis
Indiana Property Tax Equalization Project**

CntyXtwp	MajrClas	ParclCnt	AV - Total Land & Improvements	Sample Size	Sample Parcels of Popln	Sample Assessed Value Pct	Coefficient of Dispersion	Price Related Differential	Median	Lower bound	Upper bound	Imputed Market Value per Median Ratio
										of 95% confidence interval for Median	of 95% confidence interval for Median	
41 Guilford Twp	Agri-Imp	20	1,569,600	.	.	.	.	.	.	.	.	.
42 Guilford Twp	Ind-Vac	8	254,370	.	.	.	.	.	.	.	.	.
43 Guilford Twp	Ind-Imp	58	334,785,970	4	6.90	4.74	22.73	0.89	0.815	0.53	1.12	410,763,730
44 Guilford Twp	Coml-Vac	177	10,461,580	1	0.56	6.07	.	1.00	1.074	.	.	9,741,388
45 Guilford Twp	Coml-Imp	391	266,681,720	16	4.09	3.55	27.39	1.10	0.804	0.65	1.25	331,627,410
46 Guilford Twp	Res-Vac	1,056	10,741,170	1	0.09	1.39	.	1.00	0.928	.	.	11,575,362
47 Guilford Twp	Res-Imp	6,926	849,233,800	704	10.16	10.26	12.13	1.01	0.949	0.94	0.96	894,983,998
48 Liberty Twp	Agri-Vac	362	14,602,800	.	.	.	.	.	.	.	.	.
49 Liberty Twp	Agri-Imp	50	3,330,100	.	.	.	.	.	.	.	.	.
50 Liberty Twp	Ind-Imp	7	1,901,200	.	.	.	.	.	.	.	.	.
51 Liberty Twp	Coml-Vac	14	119,000	.	.	.	.	.	.	.	.	.
52 Liberty Twp	Coml-Imp	91	13,727,900	7	7.69	8.04	12.71	0.99	0.786	0.52	0.87	17,472,496
53 Liberty Twp	Res-Vac	718	7,065,800	.	.	.	.	.	.	.	.	.
54 Liberty Twp	Res-Imp	1,927	234,094,500	124	6.43	6.66	13.81	1.00	0.945	0.92	0.98	247,842,142
55 Lincoln Twp	Agri-Vac	109	3,872,900	.	.	.	.	.	.	.	.	.
56 Lincoln Twp	Agri-Imp	20	1,018,400	.	.	.	.	.	.	.	.	.
57 Lincoln Twp	Ind-Vac	8	276,700	1	12.50	11.86	.	1.00	0.929	.	.	297,734
58 Lincoln Twp	Ind-Imp	39	58,726,400	2	5.13	1.93	8.60	0.99	0.895	0.82	0.97	65,626,327
59 Lincoln Twp	Coml-Vac	97	4,617,330	1	1.03	0.21	.	1.00	0.887	.	.	5,206,438
60 Lincoln Twp	Coml-Imp	315	117,952,200	15	4.76	3.49	17.90	1.05	0.734	0.63	0.79	160,642,703
61 Lincoln Twp	Res-Vac	1,134	12,367,700	1	0.09	1.30	.	1.00	0.949	.	.	13,028,368
62 Lincoln Twp	Res-Imp	6,940	894,498,500	761	10.97	10.76	10.32	1.01	0.959	0.95	0.97	933,200,713
63 Marion Twp	Agri-Vac	259	11,183,600	.	.	.	.	.	.	.	.	.
64 Marion Twp	Agri-Imp	76	5,710,400	.	.	.	.	.	.	.	.	.
65 Marion Twp	Ind-Imp	2	564,200	.	.	.	.	.	.	.	.	.
66 Marion Twp	Coml-Imp	11	1,360,400	2	18.18	21.39	3.55	1.00	0.768	0.74	0.80	1,770,421
67 Marion Twp	Res-Vac	159	1,870,200	.	.	.	.	.	.	.	.	.
68 Marion Twp	Res-Imp	524	73,127,600	27	5.15	5.92	14.87	1.02	0.862	0.82	0.98	84,842,123
69 Middle Twp	Agri-Vac	250	8,895,800	.	.	.	.	.	.	.	.	.
70 Middle Twp	Agri-Imp	31	1,856,700	.	.	.	.	.	.	.	.	.
71 Middle Twp	Ind-Vac	2	2,035,400	.	.	.	.	.	.	.	.	.
72 Middle Twp	Ind-Imp	2	6,477,800	.	.	.	.	.	.	.	.	.
73 Middle Twp	Coml-Vac	12	213,200	.	.	.	.	.	.	.	.	.
74 Middle Twp	Coml-Imp	52	10,395,100	.	.	.	.	.	.	.	.	.
75 Middle Twp	Res-Vac	555	4,267,400	1	0.18	2.86	.	1.00	1.243	.	.	3,432,250
76 Middle Twp	Res-Imp	1,864	248,095,600	123	6.60	7.37	11.18	1.01	0.899	0.88	0.92	275,986,149
77 Union Twp	Agri-Vac	233	7,808,000	.	.	.	.	.	.	.	.	.
78 Union Twp	Agri-Imp	49	2,818,000	.	.	.	.	.	.	.	.	.
79 Union Twp	Ind-Vac	10	247,200	.	.	.	.	.	.	.	.	.
80 Union Twp	Ind-Imp	3	52,600	.	.	.	.	.	.	.	.	.
81 Union Twp	Coml-Vac	3	119,200	.	.	.	.	.	.	.	.	.

**Hendricks 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	Upper bound	Imputed Market Value per Median Ratio
										of 95% confidence interval for Median	of 95% confidence interval for Median	
82 Union Twp	Coml-Imp	32	5,195,800	3	9.38	16.42	19.05	0.86	0.877	0.66	1.17	5,923,020
83 Union Twp	Res-Vac	149	2,007,700	.	.	.	.	.	.	.	.	.
84 Union Twp	Res-Imp	647	77,812,000	43	6.65	6.64	20.20	1.02	0.950	0.87	1.05	81,910,630
85 Washington Twp	Agri-Vac	178	5,805,500	.	.	.	.	.	.	.	.	.
86 Washington Twp	Agri-Imp	14	596,600	.	.	.	.	.	.	.	.	.
87 Washington Twp	Ind-Imp	29	21,174,400	.	.	.	.	.	.	.	.	.
88 Washington Twp	Coml-Vac	108	9,708,600	1	0.93	6.63	.	1.00	1.100	.	.	8,822,884
89 Washington Twp	Coml-Imp	362	278,444,570	11	3.04	2.49	23.53	1.10	0.905	0.63	1.19	307,761,391
90 Washington Twp	Res-Vac	2,242	25,386,100	2	0.09	0.80	8.13	1.01	0.881	0.81	0.95	28,821,524
91 Washington Twp	Res-Imp	10,277	1,517,741,500	881	8.57	8.92	8.66	1.01	0.974	0.97	0.98	1,558,549,587
Total		51,363	6,609,294,510	3,466								

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	Upper bound	Imputed Market Value per Median Ratio
										of 95% confidence interval for Median	of 95% confidence interval for Median	
1 Brown Twp	Agri-Vac	199	6,862,100	.	.	.	.	.	.	.	.	.
2 Brown Twp	Agri-Imp	28	2,548,000	.	.	.	.	.	.	.	.	.
3 Brown Twp	C+I-Imp	57	48,145,400	3	5.26	4.87	34.62	1.06	0.904	0.64	1.58	53,235,663
4 Brown Twp	C+I+R Vac	630	12,473,800	.	.	.	.	.	.	.	.	.
5 Brown Twp	Res-Imp	2,932	524,526,000	324	11.05	10.70	10.35	1.02	0.958	0.94	0.97	547,559,799
6 Center Twp	Agri-Vac	288	10,858,300	.	.	.	.	.	.	.	.	.
7 Center Twp	Agri-Imp	49	3,194,700	.	.	.	.	.	.	.	.	.
8 Center Twp	C+I-Imp	300	83,530,980	14	4.67	3.35	29.06	0.87	0.819	0.59	1.25	102,030,251
9 Center Twp	C+I+R Vac	926	10,236,820	3	0.32	1.70	27.35	0.92	0.723	0.62	1.21	14,162,247
10 Center Twp	Res-Imp	3,322	447,622,600	291	8.76	8.50	13.48	1.01	0.982	0.97	1.00	456,046,133
11 Clay Twp	Agri-Vac	211	7,746,200	.	.	.	.	.	.	.	.	.
12 Clay Twp	Agri-Imp	40	1,922,300	.	.	.	.	.	.	.	.	.
13 Clay Twp	C+I-Imp	53	3,768,300	2	3.77	1.49	41.68	1.20	0.953	0.56	1.35	3,953,553
14 Clay Twp	C+I+R Vac	342	3,088,700	1	0.29	0.32	.	1.00	1.141	.	.	2,706,677
15 Clay Twp	Res-Imp	838	87,675,300	47	5.61	5.60	19.73	0.97	0.970	0.82	1.04	90,419,514
16 Eel River Twp	Agri-Vac	388	13,733,700	.	.	.	.	.	.	.	.	.
17 Eel River Twp	Agri-Imp	58	3,891,900	.	.	.	.	.	.	.	.	.
18 Eel River Twp	C+I-Imp	52	3,268,600	.	.	.	.	.	.	.	.	.
19 Eel River Twp	C+I+R Vac	239	3,762,900	.	.	.	.	.	.	.	.	.
20 Eel River Twp	Res-Imp	654	79,072,900	29	4.43	5.41	19.12	1.04	0.931	0.73	1.02	84,959,393
21 Franklin Twp	Agri-Vac	255	9,334,600	.	.	.	.	.	.	.	.	.
22 Franklin Twp	Agri-Imp	43	2,939,700	.	.	.	.	.	.	.	.	.
23 Franklin Twp	C+I-Imp	27	2,306,100	1	3.70	11.77	.	1.00	1.209	.	.	1,907,224

**Hendricks 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	Upper bound	Imputed Market Value per Median Ratio
										of 95% confidence interval for Median	of 95% confidence interval for Median	
24 Franklin Twp	C+I+R Vac	194	2,193,700	.	.	.	.	.	.	.	.	.
25 Franklin Twp	Res-Imp	500	57,350,300	19	3.80	4.67	12.76	1.03	0.964	0.88	1.05	59,508,645
26 Guilford Twp	Agri-Vac	136	4,369,800	.	.	.	.	.	.	.	.	.
27 Guilford Twp	Agri-Imp	20	1,569,600	.	.	.	.	.	.	.	.	.
28 Guilford Twp	C+I-Imp	449	601,467,690	20	4.45	4.22	26.52	1.01	0.804	0.69	0.90	747,944,674
29 Guilford Twp	C+I+R Vac	1,241	21,457,120	2	0.16	3.66	7.29	0.96	1.001	0.93	1.07	21,437,130
30 Guilford Twp	Res-Imp	6,926	849,233,800	704	10.16	10.26	12.13	1.01	0.949	0.94	0.96	894,983,998
31 Liberty Twp	Agri-Vac	362	14,602,800	.	.	.	.	.	.	.	.	.
32 Liberty Twp	Agri-Imp	50	3,330,100	.	.	.	.	.	.	.	.	.
33 Liberty Twp	C+I-Imp	98	15,629,100	7	7.14	7.07	12.71	0.99	0.786	0.52	0.87	19,892,291
34 Liberty Twp	C+I+R Vac	732	7,184,800	.	.	.	.	.	.	.	.	.
35 Liberty Twp	Res-Imp	1,927	234,094,500	124	6.43	6.66	13.81	1.00	0.945	0.92	0.98	247,842,142
36 Lincoln Twp	Agri-Vac	109	3,872,900	.	.	.	.	.	.	.	.	.
37 Lincoln Twp	Agri-Imp	20	1,018,400	.	.	.	.	.	.	.	.	.
38 Lincoln Twp	C+I-Imp	354	176,678,600	17	4.80	2.97	16.91	1.02	0.781	0.64	0.81	226,148,608
39 Lincoln Twp	C+I+R Vac	1,239	17,261,730	3	0.24	1.18	2.24	0.98	0.929	0.89	0.95	18,573,904
40 Lincoln Twp	Res-Imp	6,940	894,498,500	761	10.97	10.76	10.32	1.01	0.959	0.95	0.97	933,200,713
41 Marion Twp	Agri-Vac	259	11,183,600	.	.	.	.	.	.	.	.	.
42 Marion Twp	Agri-Imp	76	5,710,400	.	.	.	.	.	.	.	.	.
43 Marion Twp	C+I-Imp	13	1,924,600	2	15.38	15.12	3.55	1.00	0.768	0.74	0.80	2,504,670
44 Marion Twp	C+I+R Vac	159	1,870,200	.	.	.	.	.	.	.	.	.
45 Marion Twp	Res-Imp	524	73,127,600	27	5.15	5.92	14.87	1.02	0.862	0.82	0.98	84,842,123
46 Middle Twp	Agri-Vac	250	8,895,800	.	.	.	.	.	.	.	.	.
47 Middle Twp	Agri-Imp	31	1,856,700	.	.	.	.	.	.	.	.	.
48 Middle Twp	C+I-Imp	54	16,872,900	.	.	.	.	.	.	.	.	.
49 Middle Twp	C+I+R Vac	569	6,516,000	1	0.18	1.87	.	1.00	1.243	.	.	5,240,789
50 Middle Twp	Res-Imp	1,864	248,095,600	123	6.60	7.37	11.18	1.01	0.899	0.88	0.92	275,986,149
51 Union Twp	Agri-Vac	233	7,808,000	.	.	.	.	.	.	.	.	.
52 Union Twp	Agri-Imp	49	2,818,000	.	.	.	.	.	.	.	.	.
53 Union Twp	C+I-Imp	35	5,248,400	3	8.57	16.25	19.05	0.86	0.877	0.66	1.17	5,982,982
54 Union Twp	C+I+R Vac	162	2,374,100	.	.	.	.	.	.	.	.	.
55 Union Twp	Res-Imp	647	77,812,000	43	6.65	6.64	20.20	1.02	0.950	0.87	1.05	81,910,630
56 Washington Twp	Agri-Vac	178	5,805,500	.	.	.	.	.	.	.	.	.
57 Washington Twp	Agri-Imp	14	596,600	.	.	.	.	.	.	.	.	.
58 Washington Twp	C+I-Imp	391	299,618,970	11	2.81	2.31	23.53	1.10	0.905	0.63	1.19	331,165,198
59 Washington Twp	C+I+R Vac	2,350	35,094,700	3	0.13	2.41	10.19	0.91	0.952	0.81	1.10	36,849,435
60 Washington Twp	Res-Imp	10,277	1,517,741,500	881	8.57	8.92	8.66	1.01	0.974	0.97	0.98	1,558,549,587
Total		51,363	6,609,294,510	3,466								

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 propertiesⁱⁱⁱ, 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.

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.

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.

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

<i>Sample sales data to illustrate the calculation of ratio study statistics</i>	ID			
	No.	Assessment	Sale Price	Ratio
	(1)	(2)	(3)	(4)
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.	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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