2013 Level I Ratio Study

Ratio Studies

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Definition of Terms

- **Annual Adjustments:** The process of adjusting assessments annually for the effects of time. Adjustments made to assessments to reflect the effects of inflation and deflation.
- **Trending:** The process of adjusting assessments for the effects of time. Adjustments made to assessments to reflect the effects of inflation and deflation.
- **Trending Factor:** Factor to apply to properties to bring them to the assessment level in Indiana of 100%. Arrived at by dividing the assessment level by the median percentage. The trending factor represents for the relative difference in value between two time periods. This is a percentage.

Definition of Terms

Assessment Level

The common or overall ratio of assessed values to market values. This term is synonymous with assessment ratio and level of assessment. In Indiana, this is the common or overall ratio of assessed values to market values in use. The assessment level in Indiana is 100% per IC 6-1.1-1-3. This is a percentage.

IC 6-1.1-1-3 "Assessed value" or "assessed valuation" defined

Sec. 3. (a) Except as provided in subsection (b), "assessed value" or "assessed valuation" means an amount equal to:

(1) for assessment dates before March 1, 2001, thirty-three and one-third percent (33 1/3%) of the true tax value of property; and

(2) for assessment dates after February 28, 2001, the true tax value of property.

(b) For purposes of calculating a budget, rate, or levy under IC 6-1.1-17, IC 6-1.1-18, IC 6-1.1-18.5, IC 6-1.1-20, IC 20-46-4, IC 20-46-5, and IC 20-46-6, "assessed value" or "assessed valuation" does not include the assessed value of tangible property excluded and kept separately on a tax duplicate by a county auditor under IC 6-1.1-17-0.5. (Formerly: Acts 1975, P.L.47, SEC.1.) As amended by P.L.24-1986, SEC.2; P.L.6-1997, SEC.6; P.L.291-2001, SEC.204; P.L.2-2006, SEC.35; P.L.146-2008, SEC.46.

Definition of Terms

- **Level of Assessment:** The fractional relationship an assessed value bears to the market value in use of the property in question. The common or overall ratio of assessed values to market values in use. This is a percentage.
- **True Tax Value:** Synonymous with market value in use. The market value- in-use of a property for its current use, as reflected by the utility. Received by the owner or by a similar user, from the property.
- **Assessed Value:** The dollar amount for a property entered into the assessment roll. Beginning with the 2001 assessment year, the assessed value equals 100% of the True Tax Value.
- **Assessment Ratio:** The fractional relationship an assessed value bears to the market value in use of the property in question. The true tax value divided by the sales price. This is a percentage.

Definition of Terms

- **Rank:** Assessment Ratios listed in Ascending or Descending order.
- **Central Tendency:** The tendency of most kinds of data to cluster around some typical or central value such as the Mean or Median.
- **Mean:** A measure of Central Tendency. The result of adding all the assessment ratios and dividing by the number of assessment ratios.
- **Weighted Mean:** An aggregate ratio determined by adding the TTV of the entire sample and dividing that total by the sum of the sale prices for the entire sample. This is a percentage.
- **Median:** A measure of central tendency. The middle assessment ratio in a rank of assessment ratios. This is a percentage.
- **Absolute Deviation:** The difference between the assessment ratio and the median. It is not negative or positive.

Definition of Terms

- **Average Absolute Deviation:** This is the total of all the absolute deviations divided by the number of assessment ratios.
- **Coefficient of Dispersion (COD):** The average deviation of a group of numbers from the median expressed as a percentage of the median. In ratio studies it is the average percentage deviation from the median ratio. It is calculated by dividing the absolute average deviation by the median. This is expressed as a percentage.
- **Price Related Differential (PRD):** A statistic for evaluating whether high value properties are under or over assessed compared to low value properties. It is calculated by dividing the mean by the weighted mean. This is expressed as a percentage.
- **Sales Ratio:** The true tax value divided by the sales price.

Statutory Authority

IC 6-1.1-4-4.5

Annual adjustment of assessed value of real property; state review and certification; base rate methodology; adjustment in assessed value based on estimated true tax value

Sec. 4.5. (a) The department of local government finance shall adopt rules establishing a system for annually adjusting the assessed value of real property to account for changes in value in those years since a general reassessment of property last took effect.

(b) Subject to subsection (e), the system must be applied to adjust assessed values beginning with the 2006 assessment date and each year thereafter that is not a year in which a reassessment becomes effective.

(c) The rules adopted under subsection (a) must include the following characteristics in the system:

Statutory Authority (cont.)

(1) Promote uniform and equal assessment of real property within and across classifications.

(2) Require that assessing officials:

(A) reevaluate the factors that affect value;

(B) express the interactions of those factors mathematically;

(C) use mass appraisal techniques to estimate updated property values within statistical measures of accuracy; and

(D) provide notice to taxpayers of an assessment increase that results from the application of annual adjustments.

(3) Prescribe procedures that permit the application of the adjustment percentages in an efficient manner by assessing officials.

(d) The department of local government finance must review and certify each annual adjustment determined under this section.

As added by P.L.198-2001, SEC.8. Amended by P.L.245-2003, SEC.4; P.L.228-2005, SEC.4; P.L.136-2009, SEC.2; P.L.112-2010, SEC.1.

Annual Adjustment Rule

50 IAC 27-1-1 Purpose

Sec. 1. The purpose of this article is to establish procedures and standards to govern local assessing officials and the department in the annual adjustment of assessed valuations of real property under IC 6-1.1-4-4.5 and IC 6-1.1-13. The procedures, procedural requirements, and standards established by this article:

(1) shall be followed to attain a just, equal, and uniform basis and level of assessment among taxpayers in a county and from county to county; and

(2) will ensure that the annual assessed valuations are reflective of current market value-in-use conditions.

(Department of Local Government Finance; 50 IAC 27-1-1; filed Apr 8, 2010, 1:45 p.m.: 20100505-IR-050090502FRA)

Ratio Studies – Basis for Annual Adjustments

"The accuracy and uniformity of the assessments produced by any mass appraisal method shall be measured by an assessment ratio study. " (This comes from the Real Property Assessment Manual.) The Manual also contains a detailed explanation of ratio studies.

IAAO Standard on Ratio Studies

As referenced in our Annual Adjustment Rule (**50 IAC 27-1-1)** the standards to be used are the 2007 IAAO Standards. This standard provides recommendations on the design, preparation, interpretation, and use of ratio studies for equalization, the evaluation of appraisal performance, and the quality control operations of an assessor's office.

Ratio studies are the primary tool used to measure mass appraisal performance. They compare assessed values to "objectively verifiable data". In our case, a ratio study compares the assessor's estimate of TTV to indicators of market value in use. (i.e. sales prices and independent appraisals) This gives us our assessment ratio.

Ratio Studies

Sample Ratio Study for the Residential Improved Class

Sale #	True Tax Value	Sale Price	Sales Ratio	Median	ABS DEV
1	$45,800	$49,800	0.9197	0.9832	0.0635
2	$48,200	$52,400	0.9198	0.9832	0.0634
3	$42,200	$40,000	1.0550	0.9832	0.0718
4	$57,150	$58,125	0.9832	0.9832	0.0000
5	$55,300	$51,450	1.0748	0.9832	0.0916
	$248,650	$251,775	Results		0.2903
			Median	98.32%	0.0581
For the examples in this program the decimals will be rounded to four places and the percentages will be rounded to two places. Keep in mind that the computer rounds differently on occasion than your calculator.			Mean	99.05%	
			Wght Mean	98.76%	
			COD	5.91%	
			PRD	100.30%	

Ratio Studies

An assessment ratio is calculated using the following formula:
True Tax Value divided by market value in use (Sales Price) = Ratio

True Tax Value / Sale Price = Ratio

Sale #	True Tax Value	Sale Price	Sales Ratio
1	$45,800	$49,800	0.9197
2	$48,200	$52,400	0.9198
3	$42,200	$40,000	1.0550
4	$57,150	$58,125	0.9832
5	$55,300	$51,450	1.0748

For the examples in this program the decimals will be rounded to four places and the percentages will be rounded to two places. Keep in mind that the computer rounds differently on occasion than your calculator.

Ratio Studies

Ratio studies measure certain aspects of assessments:

1. **Accuracy** – the level of assessment; the overall percentage that TTV represents of market value-in-use
2. **Uniformity** – relates to fair and equitable treatment of individual properties; uniformity requires that properties be valued equitably within classes and townships and that each of these groups be valued at the same level of assessment
3. **Regressivity/Progressivity** – relates to whether lower valued properties are under- or over-assessed in relation to higher valued properties.

Ratio Studies - Statistics

1. **<u>Accuracy</u>** – shown by measures of central tendency:

   mean (arithmetic average)

   weighted mean

   median (this is the preferred measure)

2. **<u>Uniformity</u>** – shown by measures of dispersion and relative dispersion:

   average absolute deviation

   coefficient of dispersion (this is the preferred measure)

3. **<u>Regressivity/Progressivity</u>** –

   price-related differential

Ratio Studies - Statistics

Measures of Central Tendency

Mean (arithmetic average) – The result of adding all the individual ratios and dividing by the number of ratios. **Mean** = sum of ratios number of ratios

True Tax Value / Sale Price = Ratio

Sale #	True Tax Value	Sale Price	Sales Ratio
1	$45,800	$49,800	0.9197
2	$48,200	$52,400	0.9198
3	$42,200	$40,000	1.0550
4	$57,150	$58,125	0.9832
5	$55,300	$51,450	1.0748
For the examples in this program the decimals will be rounded to four places and the percentages will be rounded to two places. Keep in mind that the computer rounds differently on occasion than your calculator.	TOTAL OF SALES RATIOS		4.9526
	TOTAL NUMBER OF RATIOS		5
	MEAN		99.05%

Ratio Studies - Statistics

Measures of Central Tendency

Weighted Mean – the total of the TTV's for all sales divided by the total of the sales prices for all sales

Weighted Mean = Sum of the TTV's Sum of the Sales

Sale #	True Tax Value		Sale Price
1	$45,800		$49,800
2	$48,200		$52,400
3	$42,200		$40,000
4	$57,150		$58,125
5	$55,300		$51,450
For the examples in this program the decimals will be rounded to four places and the percentages will be rounded to two places. Keep in mind that the computer rounds differently on occasion than your calculator.	$248,650	Divided by	$251,775
		Weighted Mean	98.76%

Ratio Studies - Statistics

Measures of Central Tendency

<u>Median</u> – The middle ratio in a rank order of ratios. A rank order lists the ratios in ascending or descending order. Location of the Median in a rank order = (Number of ratios + 1) 2

	Sales Ratio	Sales Ratios Ranked
For the examples in this program the decimals will be rounded to four places and the percentages will be rounded to two places. Keep in mind that the computer rounds differently on occasion than your calculator.	0.9197	0.9197
	0.9198	0.9198
	1.0550	0.9832
	0.9832	1.0550
	1.0748	1.0748
	Median	98.32%

Ratio Studies - Statistics

Measures of Uniformity

Average Absolute Deviation – The arithmetic average of the absolute deviations of the individual ratios from the median.

Sale #	True Tax Value	Sale Price	Sales Ratio	Median	ABS DEV
1	$45,800	$49,800	0.9197	0.9832	0.0635
2	$48,200	$52,400	0.9198	0.9832	0.0634
3	$42,200	$40,000	1.0550	0.9832	0.0718
4	$57,150	$58,125	0.9832	0.9832	0.0000
5	$55,300	$51,450	1.0748	0.9832	0.0916
	$248,650	$251,775	Total Absolute Deviation		0.2903
			Average Absolute Deviation		0.0581

For the examples in this program the decimals will be rounded to four places and the percentages will be rounded to two places. Keep in mind that the computer rounds differently on occasion than your calculator.

Ratio Studies - Statistics

Measures of Uniformity

Coefficient of Dispersion (COD)= Ave. Abs. Deviation / Median

Sale #	True Tax Value	Sale Price	Sales Ratio	Median	ABS DEV
1	$45,800	$49,800	0.9197	0.9832	0.0635
2	$48,200	$52,400	0.9198	0.9832	0.0634
3	$42,200	$40,000	1.0550	0.9832	0.0718
4	$57,150	$58,125	0.9832	0.9832	0.0000
5	$55,300	$51,450	1.0748	0.9832	0.0916
	$248,650	$251,775	Total Absolute Deviation		0.2903
For the examples in this program the decimals will be rounded to four places and the percentages will be rounded to two places. Keep in mind that the computer rounds differently on occasion than your calculator.			Average Absolute Deviation		0.0581
			Median		0.9832
			COD		5.91%

Ratio Studies - Statistics

Measures of Regressivity/Progressivity

Price-Related Differential (PRD) – The mean ratio divided by the weighted mean ratio. PRD = Mean Wtd. Mean

Mean percentage from Slide 16:		99.05%
Divided by		
Weighted Mean % from Slide 17:		98.76%
Equals a PRD of		100.30%

Ratio Studies - Statistics

Measures of Regressivity/Progressivity

PRD's above 103% tend to indicate assessment regressivity; higher valued properties are under-assessed in relation to lower valued properties.

PRD's below 98% tend to indicate assessment progressivity; higher valued properties are over-assessed in relation to lower valued properties.

Evaluating Ratio Study Results

The annual adjustment rule sets the following standards:

1. **Accuracy** – Median assessment ratio for any class within a township must be between 90% and 110% of TTV.
2. **Uniformity** – The coefficient of dispersion for the Improved Residential Property class within a township must be 15% or less, while the remaining Property Classes must be 20% or less.
3. **Regressivity/Progressivity** – The PRD for all property classes within a township must be between 98% and 103%.

Ratio Studies - Evaluating Results

Median Assessment Ratio	Coefficient of Dispersion	Action Required
Accurate (90% to 110%)	Uniform	No action required
Accurate (90% to 110%)	Non-uniform	Reassess
Inaccurate	Uniform	Apply factors
Inaccurate	Non-uniform	Reassess

Ratio Studies - Evaluating Results

Evaluating the results of the sample ratio study presented in this presentation yields the following:

Median is 98.32 % and is within the 90% to 110% range we discussed and meets the 2007 IAAO Standards. This would be considered accurate.

COD is 5.91% and meets the 15% or less 2007 IAAO Standards for Improved Residential Property. This would be considered uniform.

PRD is 100.30% and is within the 98% to 103% range we discussed and meets the 2007 IAAO Standards.

After evaluating the above, this study meets the 2007 IAAO Standards and as such needs no further action.

Review of Terms

1. Annual Adjustments: Adjusts assessments annually for effects of time.
2. Trending: The process of adjusting assessments for the effects of time.
3. Trending Factor: A figure representing the increase or decrease in values over time. Expressed as a percentage
4. Assessment Level: The overall ratio of assessed values to market values. In Indiana this is 100%. Expressed as a percentage.
5. Level of Assessment: Synonymous with Assessment Level.
6. True Tax Value: The market value-in-use of a property for its current use, as reflected by the utility received by the owner or by a similar user, from the property.
7. Assessed Value: the assessed value equals 100% of the True Tax Value.
8. Assessment Ratio: True Tax Value divided by Sale Price. (a percentage)
9. Rank: Ratios listed in Ascending or Descending order.

Review of Terms

10. Central Tendency: Clustering of data around a central point.
11. Mean: Total of all assessment ratios/Total number of sales.
12. Weighted Mean: Total of all TTV of all the sales/Total sales price of all sales. Expressed as a percentage.
13. Median: Number of Ratios + 1 divided by 2 (middle ratio) Expressed as a percentage.
14. Absolute Deviation: Individual Ratio minus the Median
15. Average Absolute Deviation: Total Absolute Deviation divided by the number of ratios.
16. COD: Average Absolute Deviation divided by the Median. Expressed as a percentage.
17. Price Related Differential: Mean divided by the Weighted Mean. Expressed as a percentage.

Problems

1.)	Please find the Median in the following set of Sales Ratios:							
	0.8990	1.0980	0.9430	0.9570	0.9890	1.2000	0.9190	
2.)	Please find the Mean for the set of Sales Ratios above:							
3.)	What is the PRD for the above Sales Ratios if the Weighted Mean is 98.70?							

Problem Answers

1.)	Please find the Median in the following set of Sales Ratios:						
	0.8990	1.0980	0.9430	0.9570	0.9890	1.2000	0.9190
	Rank the above ratios in order and select the middle ratio						

Answer: 0.8990 0.9190 0.9430 **<u>0.9570</u>** 0.9890 1.0980 1.2000

2.)	Please find the Mean for the set of Sales Ratios above:

Answer: Total the above ratios and you get 7.005. Divide this total by the number of Sales Ratios (7) You get **<u>1.0007</u>**

3.)	What is the PRD for the above Sales Ratios if the Weighted

Answer: To arrive at the PRD you need to divide the Mean from #2 above by the Weighted Mean given of 98.7%. **<u>101.39%</u>**