Course 333 – Residential Modeling Building

Course Description

This course focuses on mass appraisal model building for residential properties. Along with problems and illustrations, this course uses hands-on labs and exercises along with real-world data to answer questions and construct data transformations, price trends, land and improved residential models, and ratio analyses. The course uses IBM's statistical software package, SPSS (Statistical Package for the Social Sciences), the most common statistical software package used by assessors.

Objectives

On completion of Chapter 1, the student should be able to:
• Define and describe the role of models in mass appraisal.
• Describe the advantages and limitations of mass appraisal models.
• Distinguish objective from subjective data and explain why subjective data is used in valuation and how its inherent disadvantages can be minimized.
• Distinguish between qualitative and quantitative data and provide examples of each.
• Define binary variables and describe how they are used in models.
• Distinguish between model specification and calibration.
• Understand the difference between model variables, coefficients, and terms.
• Distinguish between additive, multiplicative, and hybrid models.
• List advantages and disadvantages of each model structure.
• List the steps in model development.
• Know the common principle underlying all MRA models.
• List two alternatives to MRA for model calibration.
• List several software options available to assessors for building MRA models.
• Know how to interpret Multiple R, R-Square, Adjusted R-Square, and the standard error of estimate (see).
• Know how to calculate the coefficient of variation and average percent error for a regression model.
• Know how to interpret measure of variable importance: coefficient of correlation, standard errors of the regression coefficients, t-values, p-values, and confidence intervals.
• List several advantages, requirements, and assumptions of regression analysis.

On completion of Chapter 2, the student should be able to:
• Describe some of the basic functions or procedures found in statistical software.
• List several mass appraisal operations for which statistical software is well suited.
• Describe the two interface modes found in statistical software.
• List several examples of statistical software programs.
•List some advantages of syntax files.

On completion of Chapter 3, the student should be able to:
• Distinguish fixed length and free field text files.
• Understand that statistical packages employ traditional spreadsheet files but can read and save data in most common file types, including Excel.
• Describe some basic differences between spreadsheet programs like Excel and statistical programs like SPSS.
• Describe a frequency distribution and what types of data it can be used for.
• Describe what types of data descriptive statistics, like averages and standard deviations, are most useful for and know what data types they cannot be used for
• Describe and provide examples of cross tabulations.
• Describe and provide examples of how statistical programs can be used to generate summary statistics by a "break" variable.
• Understand that statistical packages like SPSS provide various options for displaying data and formatting output.
• Describe a histogram and the types of data it is used for.
• List some property data for which bar and pie charts would be useful.
• Describe and provide examples of scatter graphs.
• Know how to interpret a box plot and give examples of how box plots can be used for property data.
• Describe a line graph and provide examples of how line graphs can be used to analyze property data.
• Describe and provide an example of a 3-D graph.
• Understand how statistical packages create new variables from existing ones.
• Explain the different types of filters that can be used in data analysis.
• Explain how data can be stratified into sub-files for analysis.

On completion of Chapter 4, the student should be able to:
• Explain why it is important to adjust prices to the valuation date.
• Explain the difference between compounding and straight-line adjustments.
• List five methods for tracking and applying price adjustments.
• Describe resales analysis and state the advantages and disadvantages of the method.
• Describe value per-unit analysis and state the advantages and disadvantages of the method.
• Describe sales ratio trend analysis and give the advantages and disadvantages of the method.
• Describe the process of developing sale price adjustments by including time variables in regression models and explain the advantage and limitations of the method.
• List several transformations for capturing nonlinear trends.
• Explain when exponential transformations are appropriate and what their limitations are.
• Explain quadratic transformations and when they may be appropriate.
• Explain spline transformations and describe their advantages and limitations.
• Know what a price index is.
• Know how to calculate a compounding price index for a spline trend
• Know how to calculate time-adjustment factors (TAFs) from a price index.
• Explain why accurate land values are important.
• Identify the preferred and supplemental approaches to land valuation.
• List variables typically important in land models.
• Explain the difference between additive and multiplicative models.
• Explain the advantages and disadvantages of multiplicative models.
• Know how to specify and calibrate additive and multiplicative land models.
• Know how to convert the coefficients and predicted values produced by a multiplicative model to real numbers.
• List several problems often encountered in land models.
• Describe several aspects of appraisal performance.
• Know IAAO standards for residential properties and vacant land.
• Know how to calculate the median, mean, and weighted mean assessment ratios and explain why the median is the preferred measure for the measurement of assessment performance.

• Explain how to interpret the COD and COV.
• Explain a "concentration index" for helping gauge the uniformity of assessments.
• Describe appropriate graphs for helping evaluate the consistency of assessment ratios across various property characteristics, e.g., size, neighborhood, and location features.
• Interpret the coefficient of price-related bias (PRB), e.g., a PRB of -.045.
• Know IAAO standards for the PRD and PRB.
• List the two most important factors that impact the reliability of ratio study statistics.
• Know how to interpret confidence intervals and use them to determine whether one can conclude that IAAO standards, particularly those for the level of assessment, have not been met.

On completion of Chapter 5, the student should be able to:
• Define the structure of an additive model.
• Explain the difference between variables, coefficients, and terms in a model.
• State rules of thumb for the number of sales required to reliably calibrate a model.
• Explain frequency distributions, cross tabulations, scatter graphs, and box plots and their role in exploratory data analysis.
• Define a "holdout" sample and explain its role in modeling.
• Explain the difference between random and stratified samples.
• Describe the advantage and limitation of binary variables in modeling.
• Describe and advantage and limitation of scalar variables in modeling.
• Define multiplicative transformations and explain how they can make models more accurate and explainable.
• Explain exponential transformations and note several characteristics for which they are commonly used in additive models.
• Know how to apply binary, scalar, multiplicative, and exponential transformations to calculate values for subject properties.
• Explain R-Square, adjusted R-Square, and the standard error of estimate.
• Explain t-values and p-values and the relationship between the two statistics.
• Know how to interpret beta coefficients.
• Describe base models and their role in model development.
• Explain the criteria for deciding whether a model is acceptable or requires additional work.
• Explain stepwise and backward regression.
•Know how graphs can be used to help evaluate the uniformity of estimated values.

On completion of Chapter 6, the student should be able to:

• Describe the process a single property appraiser follows in using the sales comparison approach.
• Based on the Minkowski distance metric, calculate the distance metric for differences between a subject and potential comparable property.
• Explain the difference between Minkowski and Euclidean distance metrics.
• Provide criteria for determining which characteristics to use in comparable sales programs and what weight to give to each characteristic.
• Know how to apply regression coefficients to determine appropriate adjustments for differences between subject and comparable properties.
• List several criteria that may be used to limit or restrict sales used as potential comparables.
• List several advantages and disadvantages of automated comparable sales programs.

Timetable

Topic	Time Requirement	Day Covered
Chapter 1		
Definition and Role of Mass Appraisal Models	15 Minutes	Monday AM
Types of Data Used in Models	15 Minutes	Monday AM
Model Specification and Calibration	15 Minutes	Monday AM
Model Types and Structures	55 Minutes	Monday AM
Steps in Model Development	35 Minutes	Monday AM
Regression Methodology and Software Options	15 Minutes	Monday AM
Measures of Goodness of Fit	15 Minutes	Monday AM
Measures of Variable Importance	10 Minutes	Monday AM
Regression Advantages, Requirements, and Limitations	30 Minutes	Monday AM
Review Questions	15 Minutes	Monday AM
Chapter 2		
Role of Statistical Software in Mass Appraisal	10 Minutes	Monday PM
Basic Statistical Software Functions	5 Minutes	Monday PM
User Interface	5 Minutes	Monday PM
Common Statistical Software Packages	10 Minutes	Monday PM
Overview of SPSS Command Syntax	10 Minutes	Monday PM
Discussion and Review Questions	10 Minutes	Monday PM
Chapter 3		
Data	10 Minutes	Monday PM
Basic Statistical Analysis and Lab 3-1	80 Minutes	Monday PM
Format and Display Options and Lab 3-2	40 Minutes	Monday PM
Lab 3-3	85 Minutes	Monday PM/Tuesday AM
Graphs and Charts	10 Minutes	Tuesday AM
Data Transformations	25 Minutes	Tuesday AM
Data Filters and Sub-Files	30 Minutes	Tuesday AM
Review Questions		Tuesday AM

Topic	Time Requirement	Day Covered
Chapter 4		
Price Trend Analysis	45 Minutes	Tuesday AM
Lab 4-1 Price Trend Analysis: Market Area 2	185 Minutes	Tuesday AM/PM
Lab 4-2 Price Trend Analysis: Market Area 3	80 Minutes	Tuesday PM
Land Models	30 Minutes	Tuesday PM
Land 4-3 Land Models: Marketing 3	235 Minutes	Wednesday AM
Sales Ratio Analyses	50 Minutes	Wednesday AM
Lab 4-4 Sales Ratio Analyses	100 Minutes	Wednesday AM
Review Questions	75 Minutes	Wednesday AM
Chapter 5		
Structure or Additive Residential Models	15 Minutes	Wednesday PM
Exploratory Data Analysis for Additive Models	15 Minutes	Thursday AM
Holdout Samples	15 Minutes	Thursday AM
Lab 5-1 Holdout Samples	45 Minutes	Thursday AM
Data Transformations for Additive Models	30 Minutes	Thursday AM
Measures of Goodness of Fit and Statistical Significance	15 Minutes	Thursday AM
Base Model Concept	10 Minutes	Thursday AM
Lab 5-2 Developing the Base Model	180 Minutes	Thursday AM
Full Model Development, Testing, and Refinement	15 Minutes	Thursday AM
Lab 5-3 Developing and Testing the Full Model	120 Minutes	Thursday AM/PM
Review Questions	20 Minutes	Thursday PM
Chapter 6		
Overview	5 Minutes	Thursday PM
Euclidean and Minkowski Distance Metrics	20 Minutes	Thursday PM
Selecting and Weighing Variables	5 Minutes	Thursday PM
Using MRA Coefficients to Adjust Comparables to the Subject	15 Minutes	Thursday PM
Determining Estimated Values	10 Minutes	Thursday PM

Topic	Time Requirement	Day Covered
Advantages and Disadvantages of Comparable Sales Programs	5 Minutes	Thursday PM
Review Questions	10 Minutes	Thursday PM