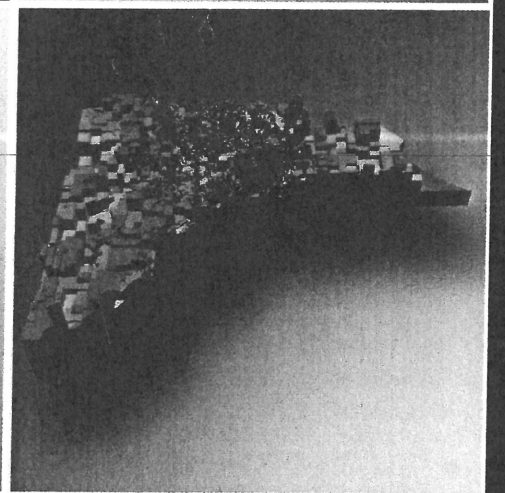
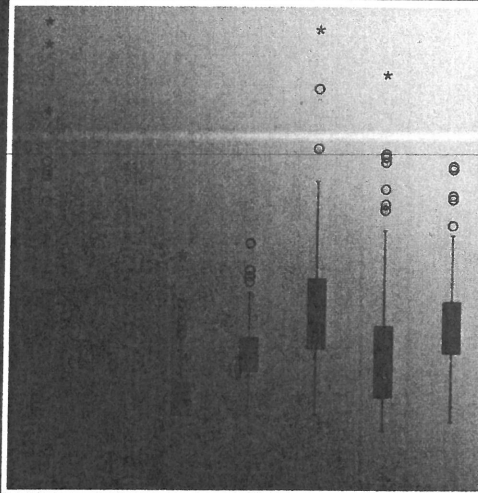
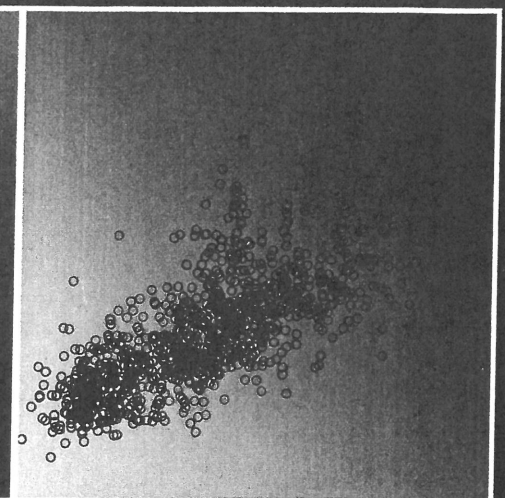
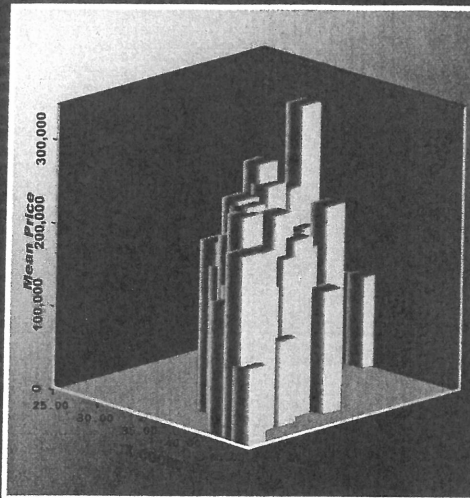


Appendix I

Fundamentals of Mass Appraisal



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recorded, discovery of these sales is difficult until the deed is finally recorded. The sale then is likely to be too old to be used.

Trades. A trade includes items of real or personal property as a portion of the price. The transaction should not be used if the items traded constitute the entire price. Otherwise, if the value of the traded items is stipulated, can be ascertained, or is small in comparison with the total price, the sale *can* be used by including the value of the items traded in the total purchase price. However, it should be a general rule to exclude sales involving trades if the full price cannot be reliably established or when there are enough valid sales without their inclusion.

Outliers. Outliers are properties with very low or very high sale prices, appraisal-sales ratios, or both as compared with other observations in the sample. Some outliers are physically dissimilar from most properties in their stratum. In some instances, a mismatch between a property as sold and the property as assessed makes the appraisal-sale ratio appear to be an outlier.

Including outliers in the sample of sales used in mass appraisal modeling or in a ratio study can distort the results, especially when the sample is small, even when the price may be accurately stated or there are no other reasons for deeming a sale unusable. Although the goal of sales screening is to obtain an adequate number of valid sales, not to find reasons to exclude sales, it is desirable to exclude outliers from analysis when they provide misleading indicators of market value.

Acceptable rules and procedures for identifying outliers in modeling are more flexible than for ratio studies made by supervisory agencies to evaluate compliance with standards or for equalization purposes and to establish a level of appraisal to be used in non-uniformity assessment appeals. In modeling, a reasonable approach is to flag for review all sale prices that fall below or above certain amounts, say, \$50,000 and \$500,000 for single-family residences, or all ratios that fall outside selected cutoff points, say, 0.50 and 1.50. Another approach is to review all prices or ratios that fall more than a specified number of standard deviations from the mean.

Procedures for trimming outliers in ratio studies conducted by oversight agencies are more rigorous. This subject is discussed in Chapter 5, "Ratio Studies in Mass Appraisal." Desirably, sales identified as outliers would be subjected to additional research rather than being automatically excluded. Because of the potentially distorting effects of extreme ratios that are atypical or for which the price and terms of sale cannot be reliably confirmed, it is prudent to exclude them.

Adjustments to Sales

As indicated, sale prices of sales used in ratio studies or as comparables in the sales comparison approach (such as part of the sample of sales used to calibrate a mass

Steps in Modeling

The primary steps in building a mass appraisal model follow.

1. *Data assembly.* The modeler must assemble the market and property characteristic data necessary to build the model. This ordinarily involves downloading the data from the CAMA system into the chosen modeling software package and formatting it for statistical analysis. Sometimes data from several source files must be merged. The model file is in spreadsheet format with property (or sometimes building) per row.
2. *Exploratory data analysis.* This involves running graphs and descriptive statistics to *explore* and clean the data. Invalid or missing data (e.g., invalid construction codes, missing lot sizes, or nominal sale prices [e.g., \$1]) must be purged or corrected. It can also be prudent to flag or remove properties with extreme or unrepresentative data, such as the occasional mansion, an atypically large lot, or properties with functional obsolescence. Judgment is required. Since all properties must be valued, it would be counterproductive to remove those that are representative of the broad range of properties found in the jurisdiction. At same time, it best to remove properties that would adversely affect representativeness of the model. Thus the relevant question is, Will removal of a property help or hinder the ability of the model to achieve accurate, representative values for the population of properties?

In addition to examining the distribution of data, the modeler should explore the relationship between property characteristics data and the dependent variable through box plots (qualitative characteristics), scatter plots (quantitative characteristics), or an examination of medians or other statistics for each value of a categorical variable. This, combined with appraisal judgment, aids in determining potential candidate variables. For example, does the relationship between lot size and price appear linear? If not, what transformation might be appropriate? Are there enough sales for each heating type? If not, which can be combined, or can heating be linearized into a single variable prior to modeling? The relationship between time and price should also be explored by using the time trend techniques described in Chapter 4, "Key Issues in Mass Appraisal." Some modelers make market condition adjustments, at least preliminary ones, at this point based on the sales ratio trend or value-per-unit methods.

3. *Base model.* Following exploratory data analysis, it is good practice to develop a base model using those property characteristics of prime importance in value determination. For single-family residential properties, these usually include living area, construction quality, age or condition, lot size, neighborhoods, and perhaps waterfront or view variables. Particularly if values have changed substantially over the study period and a preliminary market condition adjustment has not been already determined, time variables can also be included. Analogous to ensuring a sound foundation before completing construction on a house, the idea behind the base model is to ensure that the relationship between the most important property characteristics and value makes sense and provides a firm starting point. The modeler should strive to build an optimal model based on these key characteristics by testing alternative transformations before adding more variables to the model.
4. *Full model.* With the base model in place, the modeler can test variables for secondary characteristics, such as garages, porches, fireplaces, heating/cooling, and traffic in a residential model. The goal is to improve model accuracy and the equity of values while ensuring that the model remains understandable and makes sense.
5. *Sales ratio testing.* When satisfied with the full model, the modeler can save predicted values and conduct a full sales ratio examination to ensure that there is reasonable equity across all relevant property characteristics. In addition to traditional sales ratio statistics, this ordinarily involves graphical analyses, as illustrated in Chapter 3, “Data Concepts, Analysis, and Tools.” Scatter plots are used for quantitative variables and box plots for qualitative variables. This analysis reveals any notable deficiencies or areas for further improvement.
6. *Model refinement.* Assuming sales ratio analyses indicated the need for refinements, the modeler should revise the model, likely using additional variables or testing alternative transformations. Prior problem areas should be rechecked to ensure correction.
7. *Final model.* When fully satisfied that the model is equitable with no room for significant improvement, the modeler can determine final market condition adjustments (if not already done), and rerun the model a final time using time-adjusted prices. With time adjustments in place, coefficients and predicted values will represent value as of the target valuation date. Final sales ratios should be run comparing predicted values against time-adjusted prices.