Land Values Analysis
A Pragmatic Approach for Mass Appraisal Of Residential Properties In Los Angeles County

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WHERE IT ALL BEGAN...

- Alta California became a territory of the U.S. in 1848
- The California Land Act of 1851 sparked the revolution of Los Angeles from a rancho economy to the beginning of more sophisticated economy as land became accessible for other uses...
- The innovation of GIS and Geostatistics in 1960s.....
OBJECTIVES

- To build a sensible land valuation model (using ArcGIS) that can provide assessors with location-specific value prediction in Los Angeles county residential market
- To select an actual dataset that is representative yet topographically complex (elevation) in the county for demonstration
- To build an effective parcel elevation model for analysis
- To present the predictions through visualizations that highlight the geographical variations of our land value predictions
- To compare the prediction results with land abstraction method traditionally used by assessors
TODAY’S ROADMAP

- 7 recognized Techniques in vacant land valuation
- How we do it...
- Parcel Elevation model
- Prediction results compared with land abstraction method
- Conclusions
- Q&A
7 RECOGNIZED APPROACHES IN VACANT LAND VALUATION

- Comparable sales analysis
  - By far the most accurate approach to land values
    - Hedonic pricing method
    - Geostatistical approach

- Extraction

- Allocation (market-derived ratio analysis; extraction-derived)

- Cost analysis

- Ground rent capitalization

- Subdivision development (land build-up approach)

- Land residual capitalization
HOW WE DO IT...

- Use ordinary/simple cokriging techniques available in ArcGIS Geostatistical Analyst (GA) Extension
- Select a test site and apply limited vacant land sales data and integrated GIS parcel information to build various valuation models for unsampled vacant land valuation
- Validate the results with traditional appraisal technique
MODEL TEST SITE SELECTION
MODEL BUILDING: VARIABLE SELECTION EXAMPLE
MODEL BUILDING: VARIABLE SELECTION EXAMPLE

$/SF

ELEVATION
MODEL BUILDING – VARIABLES SELECTED (A CLOSE UP)
Vacant land value is spatially cross-correlated with elevation @ different locations

- Local regressions vs. Linear regression
- Showing a Local Estimator may be justified
MODEL BUILDING - ELEVATION, Z

Parcels (as points) – AIN plus X,Y coordinates

LA County Elevation Model – Z coordinates
MODEL BUILDING - ELEVATION, Z

Clip DEM with Region boundary
- ArcToolbox → Data Management Tools → Raster → Raster Processing → Clip

Select parcel points within region
- Selection → Target layer: parcels (as points) → Source layer: Region boundary → Spatial selection method: Intersect the source layer feature

Add Z value to points
- ArcToolbox → Geostatistical Analyst Tools → Working with Geostatistical Layers → Calculate Z-value

Add parcel attributes to points
- By joining tables to parcel points
ARCGIS GA EXTENSION - TREND ANALYSIS

- A weak upside-down U shape on Y-Z plan (sales price)
- A weak linear trend on Y-Z (sales price/usable SF)
- A strong U shape on X-Z plan (both sales price and sales price/usable SF)
- The strong influence is from the beach region toward inner cities
- The highest values occur in the beach region
PREDICTION RESULTS, $/SF
USABLE LAND AREA

Cokriged with Z

Ordinary Kriging only
VALIDATION - BENCHMARK THE RESULTS USING LAND RATIO

- \[ \text{LAND RATIO} = \frac{\frac{\$}{SF} \text{(OF USABLE LAND AREA)}}{\text{TOTAL MARKET VALUE (LAND + IMPROVEMENT)}} \]

- \( \frac{\$}{SF} \) is the primary variable (predicted) from the model
- Usable land area (SF) is from Assessor’s property data records
- Total Market Value is based on actual market sales ($) records
- Compare Land Ratios generated from geostatistical model with ratios generated from traditional land abstraction approach
- Examine Land Ratio consistency and normality of both results for all neighborhoods
  - Land Ratio is independent of scale (in certain range of validity)
  - Normality assumption is based on Central Limit Theorem (large samples)
## VALIDATION - SAMPLE AVERAGE LAND RATIO COMPARED

<table>
<thead>
<tr>
<th>Area</th>
<th>Classical Method (Land extraction)</th>
<th>Geostatistical Method (co-kriged)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rolling Hill Estates</td>
<td>0.76</td>
<td>0.48</td>
</tr>
<tr>
<td>NW Rancho PV</td>
<td>0.82</td>
<td>0.63</td>
</tr>
<tr>
<td>North Torrance</td>
<td>0.81</td>
<td>0.65</td>
</tr>
<tr>
<td>PV Estates</td>
<td>0.82</td>
<td>0.54</td>
</tr>
<tr>
<td>Manhattan Bch Sand</td>
<td>0.81</td>
<td>0.50</td>
</tr>
<tr>
<td>Hermosa Bch</td>
<td>1.16</td>
<td>0.75</td>
</tr>
<tr>
<td>South Torrance</td>
<td>0.73</td>
<td>0.40</td>
</tr>
<tr>
<td>South Gardena</td>
<td>0.77</td>
<td>0.46</td>
</tr>
<tr>
<td>Torrance/Holly Riviera</td>
<td>0.78</td>
<td>0.52</td>
</tr>
<tr>
<td>N Redondo Bch</td>
<td>0.65</td>
<td>0.60</td>
</tr>
<tr>
<td>E Manhattan Bch</td>
<td>0.60</td>
<td>0.52</td>
</tr>
</tbody>
</table>
VALIDATION - SUMMARY
STATISTICS COMPARED
CONCLUSION AND DISCUSSION

- We skipped the formalism of various Kriging models and appraisal principles due to time constraints.
- We demonstrated an effective modelling technique of parcel elevation in integrated geostatistical analysis.
- Kriging prediction appears to be more normally distributed than Land Extraction method for land allocation prediction.
- Kriging improves prediction accuracy since there is no need to evaluate improvement on land.
- GA extension is a valuable tool in the ArcGIS’s arsenal; and Kriging processes provide an effective option in mass appraisal; an order of magnitude of processing time may be saved in mass appraisal.
QUESTIONS

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Thank You