Hedonic Price Models and Geographical Information Systems for Mass Land Valuation in Bangkok Metropolitan Region
Hedonic Price Models and Geographical Information Systems for Mass Land Valuation in Bangkok Metropolitan Region

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Main Agendas

- How best to increase productivity and capacity in public valuation of land

- How best to promote fairness, equity, and transparency in valuation procedure

- How best to support the forthcoming new property taxation system

- How best to respond to the government’s intensive policy regarding size reduction of public organizations
Aims

- To compare econometric models with traditional methods for land valuation

- To evaluate the utility of geographical information systems for mass land valuation in Thailand
Objectives (1/2)

- To compare the benefits of modern technology and methodology with the traditional valuation method in terms of reliability and accuracy.

- To identify attributes affecting land values, such as physical characteristics, accessibility, environment, and neighbourhood quality.
Objectives (2/2)

- To eliminate or mitigate any subjective influences from traditional or human methods

- To investigate the application of geographical information systems (GIS) and mass appraisal methodologies for property taxation and other public purposes
Issues with traditional methods of land valuation

- Lack of transparency in process
  - based on human (subjective) estimation of values

- Huge time and resource consumption
  - paper-based works, number of manpower

- Gap for corruption of officials (tax evasion)
  - Use of registered property price records as the main basis for land valuation
    - This does not reflect the real price of land

- Ignorance of attributes affecting land prices
  - No clear standard how to estimate the figures
Hedonic Pricing Method

“The hedonic pricing method places emphasis on the relationship between selling price and attributes of properties for estimating values of properties” (Rossini, 1997).
Geographical Information System (GIS) (Land Management Concepts)

- “a database management system used to store, retrieve, manipulate, analyze, and display spatial information” and

- “one type of computerized mapping system capable of integrating spatial data (land information) and attribute data among different layers on a base map.”

(International Association of Assessing Officers, 2002)
Main Criteria for Research Area Selection

- Data Availability (spatial and non-spatial)
- Diversity of Land Uses
- Area Size and Time Limitation
3D Model of Research Area: Bangbuathong, Nonthaburi (Peri-Urban Area)
3D Model of Research Area: Nongkhaem, Bangkok (Urban Area)
<table>
<thead>
<tr>
<th>Variable</th>
<th>Type</th>
<th>Unit</th>
<th>Description</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Physical Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Lot size</td>
<td>quantitative</td>
<td>wah</td>
<td>wah = 4 square meters</td>
<td><em>(Ward 2001; Rossini 2006)</em></td>
</tr>
<tr>
<td>• Parcel width</td>
<td>quantitative</td>
<td>meter</td>
<td>average width of land lot</td>
<td></td>
</tr>
<tr>
<td>• Parcel depth</td>
<td>quantitative</td>
<td>meter</td>
<td>average depth of land lot</td>
<td></td>
</tr>
<tr>
<td>• Soil elevation</td>
<td>quantitative</td>
<td>meter</td>
<td>soil elevation comparing with frontage road</td>
<td></td>
</tr>
<tr>
<td>• Land shape</td>
<td>dummy</td>
<td>(1,0)</td>
<td>normal, abnormal, axe shape, corner, triangle, 2 sides frontage</td>
<td></td>
</tr>
<tr>
<td><strong>2 Environment</strong></td>
<td>five</td>
<td>very good-poor</td>
<td>air, water, and noise, levels of pollution</td>
<td><em>(Glougemans 2002; Bagdonavicius 2004)</em></td>
</tr>
<tr>
<td><strong>3 Neighbourhood Quality</strong></td>
<td>Five</td>
<td>Very good-poor</td>
<td>Development project and quality, community management, security, and maintenance</td>
<td><em>(Bagdonavicius 2004; Laposa 2005)</em></td>
</tr>
<tr>
<td>Variable</td>
<td>Type</td>
<td>Unit</td>
<td>Description</td>
<td>References</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------</td>
<td>----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td><strong>Accessibility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Access</td>
<td>quantitative &amp; qualitative</td>
<td>metre (1,0)</td>
<td>type, width, condition (3 categorical levels), surface of frontage road and access</td>
<td></td>
</tr>
<tr>
<td>• Utility and service</td>
<td>quantitative</td>
<td>kilometer</td>
<td>distances to public utilities, services, business areas, and transportation</td>
<td></td>
</tr>
<tr>
<td><strong>Existing land use</strong></td>
<td>qualitative</td>
<td>(1,0)</td>
<td>residential, commercial, agricultural, and vacant</td>
<td></td>
</tr>
<tr>
<td><strong>Building &amp; Improvement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Types</td>
<td>qualitative</td>
<td>(1,0)</td>
<td>townhouse, shop-house, single house, semi-detached house etc.</td>
<td></td>
</tr>
<tr>
<td>• Building area</td>
<td>quantitative</td>
<td>Square metre</td>
<td>total building areas calculated from dimension and stories</td>
<td></td>
</tr>
<tr>
<td>• Building age</td>
<td>quantitative</td>
<td>years</td>
<td>The deference of building and selling year</td>
<td></td>
</tr>
<tr>
<td>• Material quality</td>
<td>three categoric levels</td>
<td>good-poor</td>
<td>material quality</td>
<td>(Ward 2001; Rossini 2006)</td>
</tr>
<tr>
<td><strong>Selling price</strong></td>
<td>quantitative</td>
<td>Baht/wah</td>
<td>registered and interviewed</td>
<td></td>
</tr>
</tbody>
</table>

(Dependent)
Problems with qualitative variables

- How can qualitative variables (e.g. environment, neighborhood) be defined without subjectivity?

- Are there any more attributes affecting the prices of lands in the study areas?
## Measurement of Qualitative Variables
*(Based on Local People Knowledge)*

<table>
<thead>
<tr>
<th>Type</th>
<th>Guidelines for Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Road Condition</td>
<td>Surface Condition and Safety</td>
</tr>
<tr>
<td>2 Air pollution</td>
<td>Duration of Emersion and Degree of Danger</td>
</tr>
<tr>
<td>3 Water Pollution</td>
<td>Waste Accumulation and Duration of Spoiled Flood</td>
</tr>
<tr>
<td>4 Noise Pollution</td>
<td>Proximity to Polluted Source and Duration of Polluted Activity</td>
</tr>
<tr>
<td>5 Quality of Development</td>
<td>Reputation of Developer and Building Style and Design</td>
</tr>
<tr>
<td>Project</td>
<td></td>
</tr>
<tr>
<td>6 Maintenances</td>
<td>Maintenance and Environment Protection</td>
</tr>
<tr>
<td>7 Safety</td>
<td>Security Staff and CCTV</td>
</tr>
</tbody>
</table>
Process of Sales Data Collection and Record

Registered Property Sale Database

Investigation and Interview (Sales Data Collection Form)

Property Sale Map

Land Parcel Ownership Database

Attribute Data
- Physical Characteristics
- Accessibility
- Neighborhood
- Environment
- Land Use

Property Sale Price
1) Vacant Land
2) Residential
3) Commercial

Building Inspection
Area, Condition, Types (Detached House, Townhouse, Shop-house)

Financial Adjustment

Present Price of Whole Property

Building Cost & Depreciation

Present Price of Land

Recording

Land Price and Attribute Database for Hedonic Price Analysis
II....GIS Section
GIS-related Processes

Spatial Data

- Base Maps
  - Orthophotograph
  - Satellite Image
  - Building Map
  - Access Map
  - Zoning Map
  - Waterway Map
  - Administrative Area Map

- Parcel Map

Non-Spatial Data

- Property Sale Database
- Empirical Data
- Hedonic Price Modeling-Based Database

Spatial Analysis

- Land Sale & Property Sale Map
- Land Value & Attribute Map
- 3D Land Value Map

Parcel Identification Number
GIS visual outcomes of land values
Compiled Sale Map for Site Investigation
Display of land value database in accordance with geographical sites
3D Land Value Model: Sample Area in Research Area 1

Display of Land Value Patterns and Clusters
3D Base Map: Sample Area in Research Area 1
Display land value database in accordance with geographical sites
3D Land Value Model: Sample Area in Research Area 2
3D Base Map: Sample Area in Research Area 2
3D Land Value Model: Sample Area

Research Area 1

Research Area 2
## Summary of Work Done to Create Research Database

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Types of Data</th>
<th>Cases (Rows)</th>
<th>Filled Field (Columns)</th>
<th>Filled Cells (Records)</th>
<th>Processes Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Questionnaire Responses’ Database</td>
<td>40 Pre-tested</td>
<td></td>
<td>Open Question</td>
<td>Coding, Recording, Summary, and Graphic Presentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>127 Responses</td>
<td>130</td>
<td>16,510</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Sales Collection Database</td>
<td>1,999 Inspected Sales Data</td>
<td>130</td>
<td>259,870</td>
<td>Measuring, Coding, Ranging, and Recording, Amending</td>
</tr>
<tr>
<td>3</td>
<td>Significant Variable Figures</td>
<td>3,038 Predicted Parcels</td>
<td>24</td>
<td>64,841</td>
<td>Inspecting, Quantifying, and Recording</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>4,204</td>
<td>284</td>
<td>341,221</td>
</tr>
</tbody>
</table>
Conclusions

- Huge amount of work involved in developing both the hedonic price model and the GIS

- This would be costly for the whole country at initial stage
  - All data models do explain over 78.0% of variation in land value
  - Allowance for frequent update, fast production time

- Clear benefits in terms of accuracy, replication and transparency of process
  - But relies in part on subjectivity of attributes
  - Taken into account significant variables affecting land prices