Land Values: What Have We Learned and Where Do We Go From Here?

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January 29, 2021

Land Value Estimation: Some Guiding Principles

- ▶ Readily available data

- ▶ Accurate data

- ▶ No sample selection bias

- ▶ Comprehensive geographic coverage

- ▶ Large number of observations

- ▶ Levels as well as changes over time

- ▶ Accessible to assessors

- ▶ Assessors need to value *all* parcels, but not necessarily using the same method.

Extensions of Traditional Approaches

- *Vacant Land Sales / Teardowns*
    - Larson, William and Jessica Shui, "Land Valuation using Public Records and Kriging: Implications for Land Versus Property Taxation in Cities."
    - McMillen, Daniel and Ruchi Singh, "Land Valuation Estimation Using Teardowns."
    - Peltola, Risto, "Automated Land Valuation in Maricopa County, AZ."
- *Hedonic Approaches*
    - Cohen, Jeffrey, "Land Value Estimation in Maricopa, AZ: A Space-Time Local Regression Approach."
    - Zabel, Jeffrey, "A Matching Method of Land Valuation."
- *Machine Learning Extensions to Hedonic Approaches*
    - Johnson, Erik, "Land Values and Machine Learning."
    - Yang, Zhou, "A Modern Approach to Land Valuation: An Application of Artificial Neural Networks."
- *Depreciated Cost / Residual Approaches*
    - Bourassa, Steven and Martin Hoesli, "Land Valuation using a Mix of Hedonic and Depreciated Cost Methods."
    - Clapp, John and Thies Lindental, "The Valuation of Urban Land: Comparison and Critique of Three CAMA Methods."

Hybrid Approaches

- Estimate land / price ratio and then apply to hedonic estimates, or subtract estimates of improvements from hedonic estimates.
  - Bourassa and Hoesli.
  - Clapp and Lindental.
- Combine Land Sales and House Sales
  - Albouy, David and Minchul Shin, "A Statistical Learning Approach to Land Valuation: Optimizing the Use of External Information."
  - McMillen and Singh.
  - Redfearn, Christian, "Estimating Land Values Using Residential Sales Data."
  - Repeat Sales?
- Combine information from vacant land sales and sales of housing.
  - Albouy and Shin, "A Statistical Learning Approach to Land Valuation: Optimizing the Use of External Information."
  - McMillen and Singh, "Land Valuation Estimation Using Teardowns."

Issues with Traditional Methods

1. Vacant Land Sales
   - ▶ Geographic coverage: built up areas tend to have few sales.
   - ▶ How representative are vacant land sales?
   - ▶ Can be very hard to classify correctly because vacant lots are often developed after a sale. A sale of a lot next to a home may carry one price for the combination. Subdivision of lots may make lot size variable unreliable. Strong incentive for landowners to have assessors think a developed lot is still undeveloped.

2. Depreciated Cost: Use RS Means data on costs to calculate value of the property as if it were new. Subtract depreciation. Result is an estimate of the value of the current structure. Subtract from sale price to get land value.
   - ▶ Works best for relatively new properties.
   - ▶ Estimates can be negative.

3. Hedonic: Standard missing variables problems. Missing variables are almost certainly correlated with location.

Some Data Issues

- How often are variables updated?
- What variables are missing?
- How accurate is the data?
- How are neighborhoods defined?
- Is vacant land really vacant?
- Can subdivisions of vacant land be tracked over time?
- Can vacant land sales be matched to subsequent sales of developed property?
- Quality of data from assessors v. data from commercial providers.

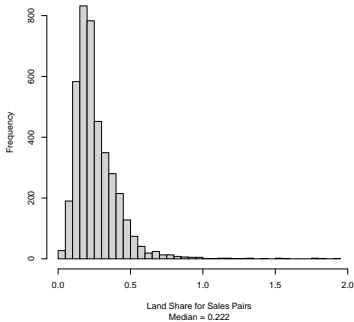# Pairing Vacant Land Sales with Subsequent Developed Sales

▶ CoreLogic data for Maricopa County and Cook County, 1996 - 2017. Lot size is only observed for 2014.

▶ Match sales of vacant land with subsequent sales of residential properties with buildings. Limit sample to pairs where the developed sale took place within 48 months of the vacant land sale. Same lot size for both sales in the case of assessor data.

▶ Estimate a repeat sales price index based on all sales of residential properties.

▶ Adjust prices for developed properties to time of the vacant land sale.

▶ Epple, Gordon, and Sieg (AER, 2011): Relationship between land value per acre and house price per acre implies the form of the production function for housing

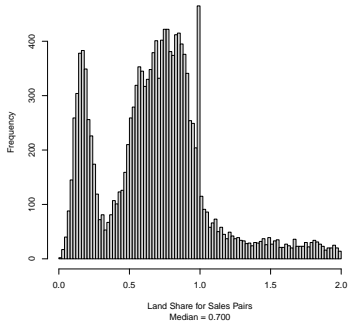Table: Sample Sizes for Vacant Land Sales in Maricopa and Cook County

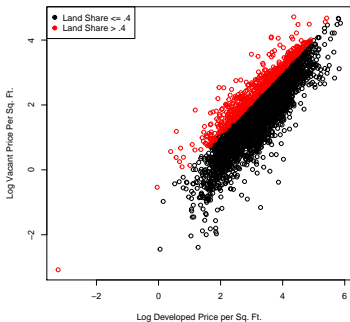| Sample	Maricopa Assessor	Maricopa CoreLogic	Cook Assessor	Cook CoreLogic
Vacant Sales	88,754	88,517	14,544	14,644
Vac. & Dev. Pairs	24,477	48,554	11,914	11,153
Same Lot Size	14,429	48,554	11,914	11,153
48 Month Window	4,073	15,064	867	1,499
Land Share $< .4$	3,496	3,201	351	953

Land Shares for Maricopa County Data

Land Shares for Cook County Data
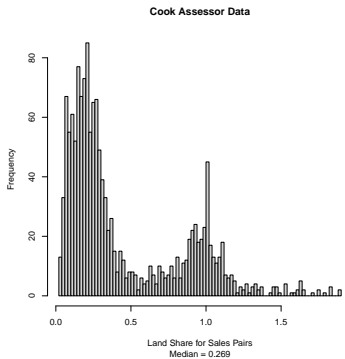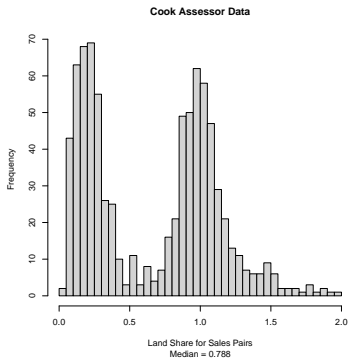
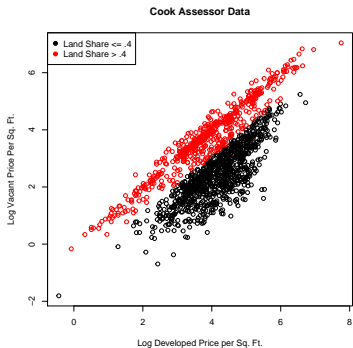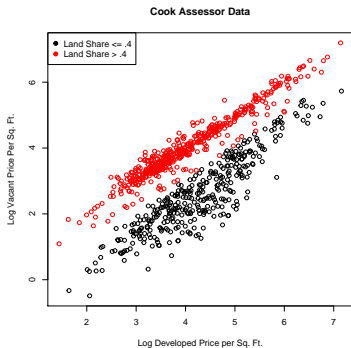# Data Plots for Maricopa County Data
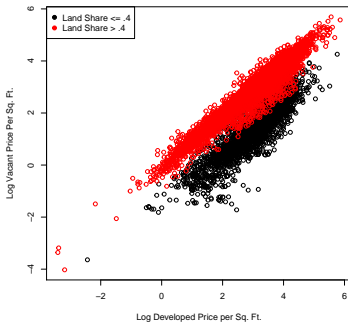
Data Plots for Cook County Data

Where Do We Go From Here?

▶ A reliable estimator requires large numbers of observations of representative properties.

▶ Vacant land sales are concentrated geographically – may be useful in those areas, but another approach is required elsewhere.

▶ Hedonic approaches take advantage of the larger number of developed sales, but are likely to produce biased estimates of coefficients for location variables because missing variables are almost certainly correlated with location. Fixed effects may be estimated more accurately than coefficients for variables like lot size.

▶ Residual approaches are problematic if they produce negative land value estimates.

▶ An approach that needs to be investigated is to start with estimates of land shares for newly developed properties, and then adjust for depreciation. Will work best if (1) land share at construction does not vary significantly within a metro area, and (2) it is possible to get good estimates of depreciation.

▶ A possible alternative (or complement): estimate land value at discrete times and update using a repeat sales or other price index for developed properties.

▶ General point: Some approaches – vacant land sales, teardowns, residual approach – may work well in areas of a city where they are well suited. In other areas, it will be necessary to use information on sales of developed properties to estimate land values accurately.