

Effect of Environmental Amenities on Home Values in the Upper Santa Cruz Basin:

A Hedonic Analysis Using Census Data

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¿ Hedonic Pricing ?

- Application: Economic analyses of certain 'peculiar' goods like homes, automobiles, i *WINE* !,....., etc.
- Why 'peculiar'?
 - Consumers pay an aggregate price for a host of attributes that bundle up to define the good in question.
 - We DO NOT observe the differentiated prices of each of these attributes but DO observe the aggregate price.

➤ Therefore, for homes:



$$\text{PRICE}_{\text{HOME } i} = f(\text{Structure } _i, \text{Neighborhood } _i, \text{Environment } _i, \text{---})$$

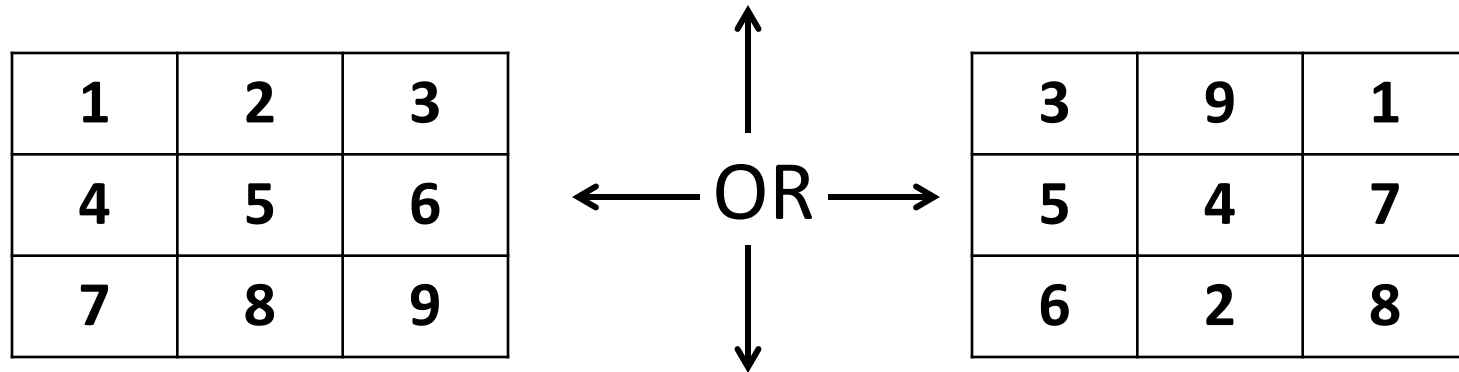
OR

$$\text{PRICE}_{\text{HOME } i} = a + b * \text{structure } _i + c * \text{Neighborhood } _i + d * \text{Environment } _i, \text{---}$$

REVEAL CONSUMER PREFERENCES

ISSUE OF SPATIAL AUTOCORRELATION

- Can the location of various homes in an area be considered random?



- Is the price of a housing unit an isolated number or is it (partially) defined by the value of surrounding housing units.

➤ ***Intuition:***

Home Buyers DO PAY ATTENTION to price of neighboring homes!

➤ ‘*Usual*’ hedonic studies do not consider the issue of spatial autocorrelation or *simply* connection in space. ***SHOULD THEY?***

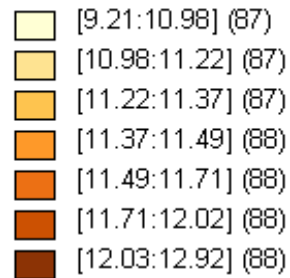
WHAT DO WE FIND?

- Data: Source – US Census 2000.
 - Unit of Observations: Census Block-groups. (Schultz and King 2001)
 - $N = 613$.
 - Dependent Variable: $\log_N \text{Price}$
- We evaluate the degree of connectedness in space:
 - Define the connection by defining a Weights Matrix '**W**'
 - A $N \times N$ matrix with 1 for a neighbor and 0, otherwise.
 - Calculate the Moran's I test statistic as *slope* of **$W \cdot \log_N \text{Price}$** vs. **$\log_N \text{Price}$** scatter plot.
 - Finding: $I = 0.2878$; statistically significantly different from 0 @ 99% C.I.

LOW - HIGH

HIGH - HIGH

Quantile: LNPRICE

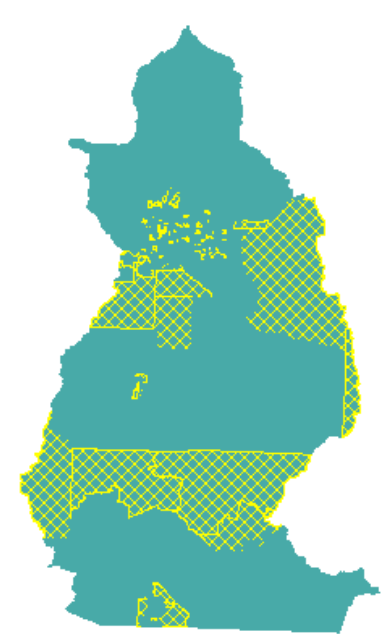
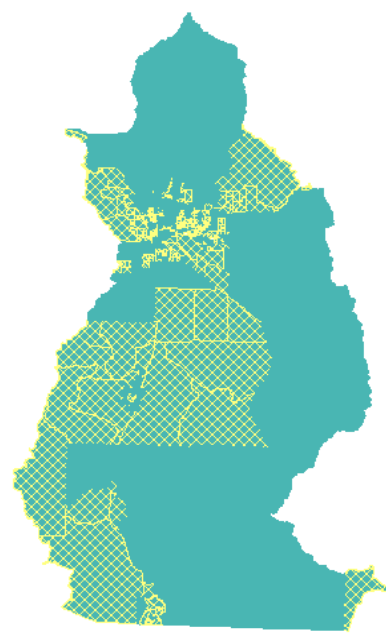
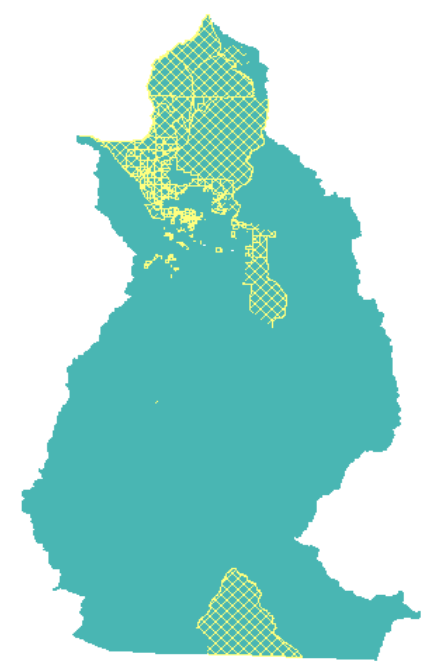
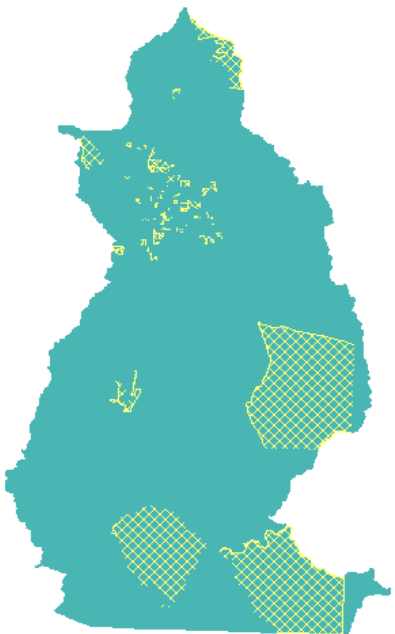


HIGH - HIGH

↓
Expensive
CBGs with
Expensive
Neighboring
CBGs ,
etc....

LOW - LOW

HIGH - LOW



Literature Review

- Bark et al. 2008 suggests that **Quality vs. Quantity & Manmade vs. Natural Habitat MATTERS!**
- Bark et al. 2011 says that people prefer “greener” lots, “greener” neighborhood & “greener” riparian habitat. Use vegetation indices like NDVI and SDVI to define ‘*greenness*’. Again -> Quality Matters!
- Proximity to riparian corridor ↑ => Home Values ↑
 - Colby and Wishart (2002) – for Tucson, AZ.
 - Bourne and Frisvold (2007) – for Rio Rico, AZ.

BUT...

- All the above studies are conducted with household level data with homes in fair proximity to riparian corridor.
- ISSUE:
 - Results cannot applied in policy implications for a larger region.
 - Cannot extrapolate the methodology!
- Above studies do recognize this issue but cannot correct for it!

Methodology(1)

- *Block-group level of aggregation* allows for a large area under study.
 - *Incorporates rural vs. urban; close to and far off amenities!*
- Recognize *spatial regimes or submarkets using DUMMY variables*:
 - ON THE US-MEXICO BORDER.
 - NEAR TUCSON INTL. AIRPORT or DAVIS MONTAN AIR BASE.
 - CATALINA FOOTHILLS & TANQUE VERDE SCHOOL DISTRICTS
- Environmental Amenities:
 - Open Space
 - Land Ownership (NPS, USFS, BLM, State Trust, Local Parks)
 - *Vs.*
 - Land Cover/ Land Use(grasslands, wetlands, forests, pasture etc.)
 - Biodiversity Index: Higher the index, higher the biodiversity potential.

$$\text{Index} = \sum_i (N_{\text{species}})_i * (\% \text{land under vegetation})_i$$

Methodology (2)

→ List of Other Variables:

Neighborhood Variables:	Structural Variables:	Contractual variables
<i>% homes vacant (vs. occupied)</i>	<i>Median # of rooms</i>	<i>% housing units occupied by an owner (vs. rented)</i>
<i>% mobile homes</i>	<i>% of homes without a phone</i>	
<i>% housing units built in last two years.</i>	<i>% of homes without complete plumbing</i>	
<i>% housing units built before 1939.</i>	<i>Persons / Home</i>	
<i>% area under 100-yr Floodplain (FERMA)</i>		
<i>% Non-whites</i>		
<i>% earning population</i>		

Methodology (3)

- Estimate hedonic price elasticity for each of the environmental amenity.

$$\text{Price Elasticity of amenity 'A'} = \frac{\% \text{ change in Hedonic Price (P)}}{\% \text{ change in A}}$$

- Interpreted as % change in home values given a unit change in % of amenity in question.
- Estimate continuous rate of change in hedonic prices across various submarkets.
 - OR simply, *% change in home values when we move from market A ($D = 0$) to market B ($D = 1$).*

Results (1)

- Higher Biodiversity potential increases home values.
- The extent of public land & '*Land cover*' variables implying natural amenities do incorporate economic significance in terms of premiums paid on home values.
- Land Ownership vs. Land Cover ➔ Land Cover dominates
- Open space does matter!

Results (2)

- At submarkets:
 - On the *Border* (<15 miles), home values fall by at least 24%.
 - Near Tucson Intl. Airport & DM Airbase, home values fall by at least 13%
 - In a CBG w/ Cat. Foot. & Tanque Verde Schl. Dist., home values increase by at least 19%.

Results (3)

Estimated Elasticity: Examples

LAND OWNERSHIP VARIABLES

Variables	@ Min	@ Max	@ Mean
% State Trust	0	0.334	0.010
% National Park	0	0.410	0.002
% Forest Service	0	0.629	0.011

LAND COVER VARIABLES

% Shrub/Scrub	0	0.402	0.048
% Grassland	0	0.686	0.014
% Pasture	0	0.392	0.014

Biodiversity Index	0.257	0.860	0.421
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Results (4)

- Elasticity of environmental amenity is *NOT CONSTANT* for all the home buyers in the area under study.
 - Response depends on what they begin with!
 - If home buyers have more amenity to start with then their response will be more drastic for a change in amenities (at margin).

Contribution:

- Large Area under study and use of census data makes our results generalizable.
- We correct for spatial autocorrelation, which can bias the computed elasticity by up to 25%.

¿ Questions / Comments ?