

Commercial and Residential Land Prices Across the United States

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Note: The data for this study were provided by the CoStar Group, Inc. The views expressed herein are those of the authors alone and should not be attributed to the Board of Governors of the Federal Reserve System or other members of its staff.

Why Focus On Land Prices?

- Land is a large component of aggregate wealth
 - Very rough estimate of land value in U.S: nearly \$4 trillion in 2010:Q1
 - Based on Flow of Funds data
- Land values likely account for bulk of variation in home prices over time
 - Davis and Palumbo (2008), Davis and Heathcote (2007)
 - No evidence yet on the commercial side
- Land values are important for health of banks
 - Primary source of collateral for construction loans
 - Delinquency rate for these loans is extremely high now

Previous Estimates of Land Prices

- Many studies for single cities or other narrow areas
 - Recent example: Haughwout et al. (2008) for NYC metro area
- Only a few studies with broader scope
 - Davis (2009), Davis and Palumbo (2008), Davis and Heathcote (2007) infer land prices from data on real estate prices and construction costs. No transaction data.
 - Sirmans and Slade (2009) estimate national indexes using transaction data, but there are issues with their methodology, and they provide no indexes for individual MSAs.

Our Contribution

- Provide the first land price indexes with broad geographic coverage using transaction data.
 - 23 individual MSAs and aggregate of those MSAs
 - More than 170,000 transactions from mid-1990s through 2009
- Characterize the swings in land prices over the recent boom-bust cycle in real estate.
- Results fill a hole in empirical literature on real estate economics. Also useful for bank supervisors and agencies producing national accounts.

Key Results

- Land prices rose moderately from 1995 until about 2002 and then jumped, peaking in 2006 or 2007. Prices have since dropped sharply.
 - Aggregate index rose more than 130 percent from 2002:H2 to 2006:H2.
 - Has since reversed 3/4 of that jump.
- The run-ups and subsequent declines were largest on the East coast and in the Far West.
- The swings in land prices were larger than those in commercial real estate and house prices.

Data

- From CoStar database (“COMPS”) on sales of commercial real estate and land in U.S.
- CoStar obtains data from public records, interviews with parties to the transactions, and field inspection.
- Definition of land transactions: property is vacant or has unoccupied structures slated to be demolished.
- Residential land must have at least 5 SF lots or 5 MF units. No minimum size for commercial or industrial land.

Data, continued

- Each record contain sales price, location, and a series of text fields describing land parcel and transaction.
- We downloaded all land transactions in COMPS and applied a series of screens.
 - Restrict sample to 23 MSAs with richest data
 - Set aside observations before 1995
 - Exclude non-market transactions, outliers that appear to contain errors, sales too far outside MSA-specific grid, and MSA-specific half-years with too few sales.
- Result is a sample of 172,000 transactions.

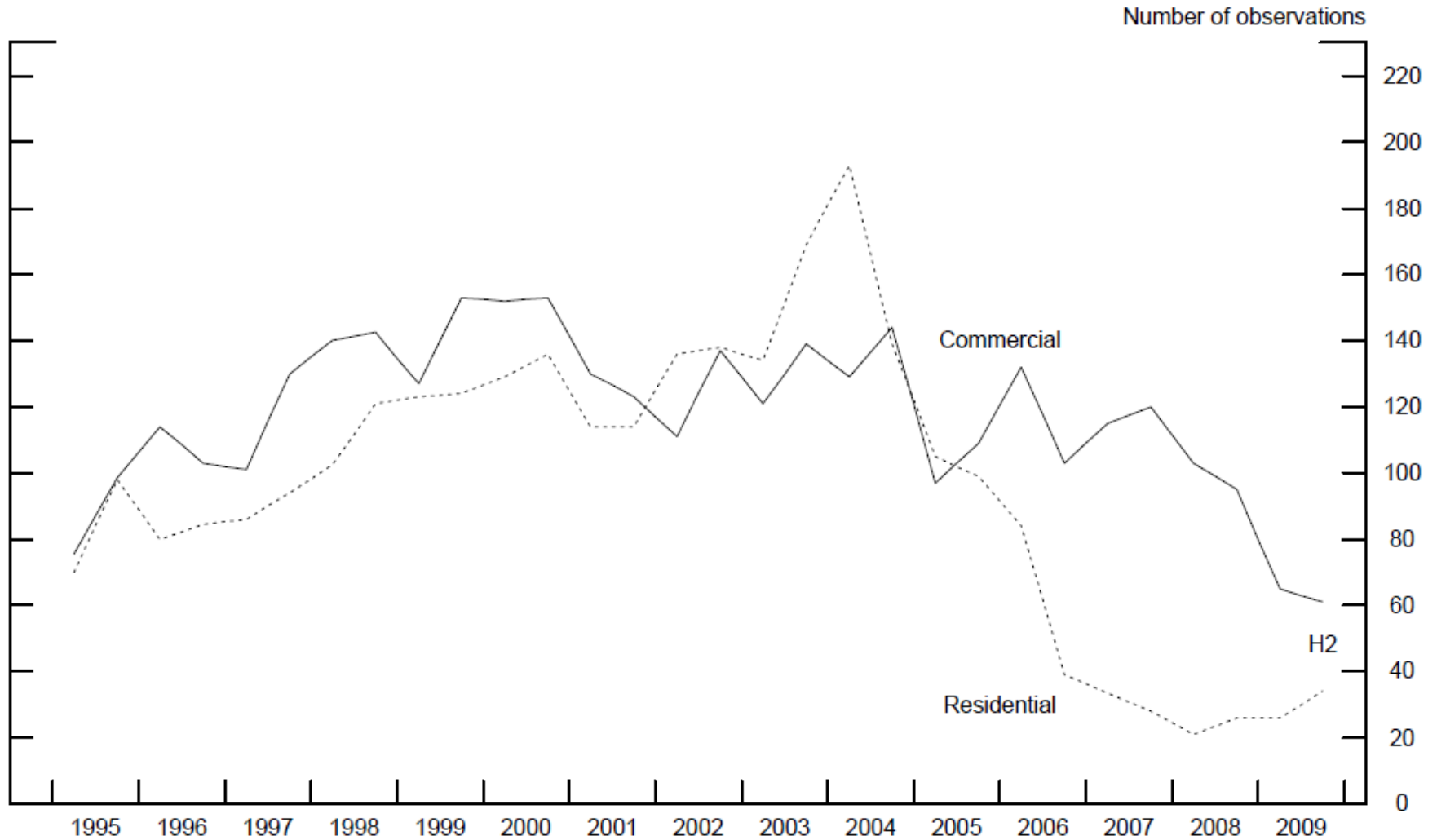
MSAs in the Sample

East Coast	West Coast	Other
Boston	Seattle	Las Vegas
New York	Portland	Phoenix
Philadelphia	San Francisco	Tucson
Baltimore	Sacramento	Denver
Washington DC	Los Angeles	Dallas
Orlando	San Diego	Houston
Tampa		Atlanta
South Florida		Chicago
		Detroit

Sample Size, Selected MSAs

MSA	Starting period	Number of sales		
		Total	Commercial	Residential
Total	1995:H1	171,678	94,032	76,949
Chicago	1995:H1	13,968	8,241	5,727
Phoenix	1995:H1	17,423	8,120	9,303
Sacramento	1995:H1	2,405	1,606	416
New York	1998:H2	6,459	3,756	2,703

Sample Size by Year



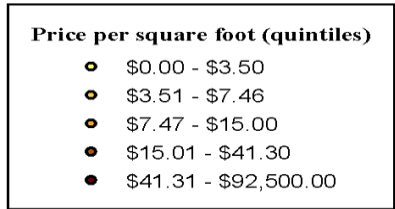
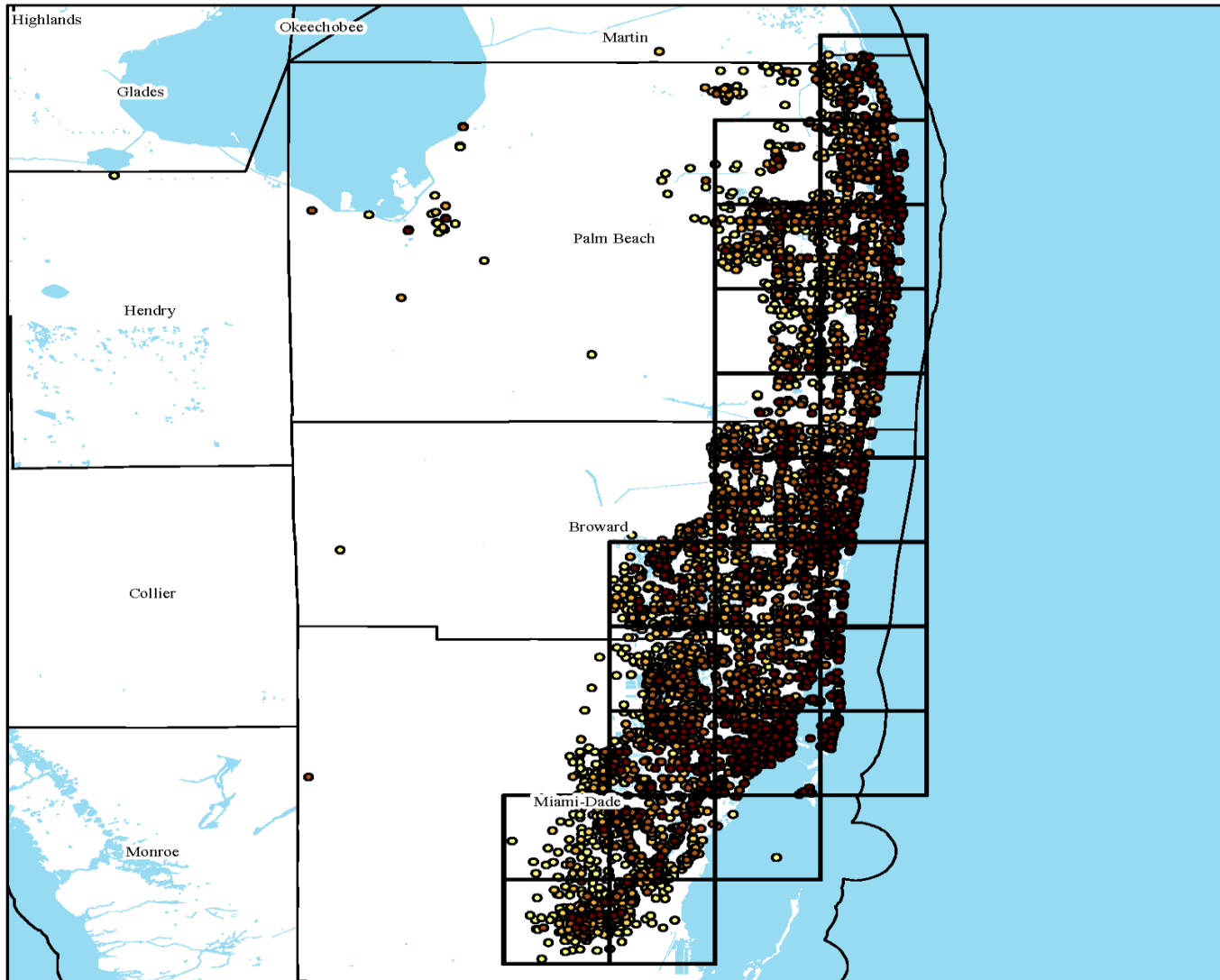
Locational Effects

- Property value depends on location, obviously.
- Land-price studies often model location effects with distance from CBD.
 - But many MSAs are not monocentric (e.g., Washington DC) and many are not symmetric (e.g., South Florida).
 - So, linear price gradient from CBD likely not sufficient
- Most studies include other variables as well. Examples:
 - Distance from major roads, rail lines, and airports
 - Distance from suburban business nodes
 - Distance from coastline

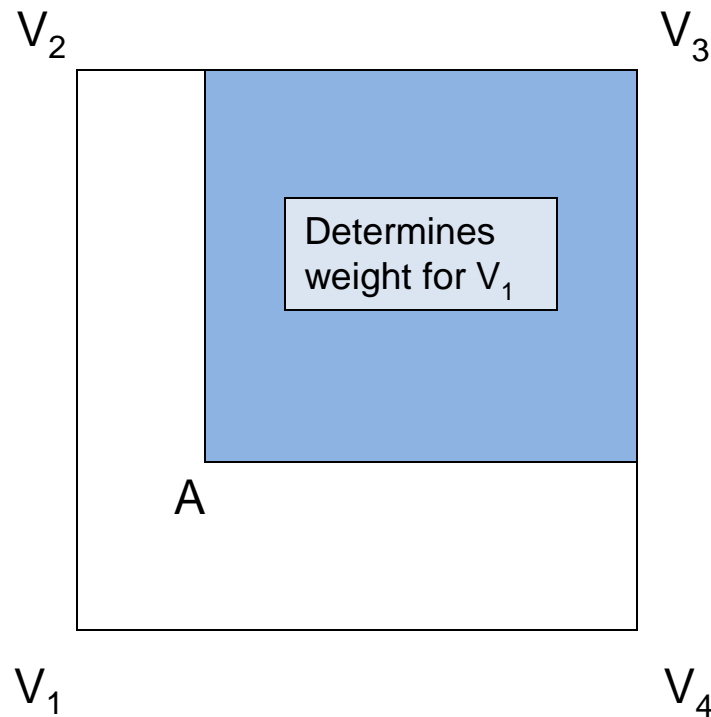
Locational Effects, continued

- With 170,000+ transactions in 23 MSAs, not practical to specify a set of location variables for each observation.
- Solution: Use distance from CBD combined with Colwell's (1998) semiparametric grid method.
- Colwell's method:
 - Superimpose a grid on the MSA
 - For each observation, assign a weight to each of the four surrounding grid vertices based on distance to each one
 - Each vertex enters the regression as a separate variable
 - The regression estimates height of price surface at each vertex

Grid for South Florida



Calculation of Vertex Weights



Hedonic Land Price Regression

- Dependent variable: log of land price per square foot
- Pool all observations in a single regression
- Weight the observations to reflect importance of each MSA in national stock of real estate
- Allow coefficients to vary by MSA and broad property type (commercial vs. residential)
- Estimate by MLE with variance/covariance matrix that allows error variance to differ by MSA

Explanatory Variables

- Property type dummies (omitted type: office)
 - Industrial, retail, single-family, multifamily rental, other residential
- Condition of property (omitted category: unimproved)
 - Graded, paved, finished, fully improved, platted and engineered, previously developed, improvements unknown, structure present, environmental problems
- Log of parcel size
- Intended use (omitted category: private investment)
 - Public use, hold for investment, open space, unknown use, sold as part of expansion plan

Explanatory Variables, continued

- MSA dummies (omitted MSA: New York)
- Log of distance from employment-weighted center of CBD
- Grid vertices
- Half-yearly time dummies

Results: Commercial Land

Variable	Median coefficient	# Significant	
		Negative	Positive
Log of parcel size	-.52	23	0
<i>Type of property</i>			
Industrial	-.41	23	0
Retail	.20	0	22
Other commercial	-.11	14	1
<i>Condition of property</i>			
Graded	.10	0	12
Paved	.14	1	10
Finished	.06	0	7
Fully improved	.25	0	11
Platted and engineered	.12	0	4
Previously developed	.15	0	14
Improvements unknown	-.09	12	0
Structure present	.11	0	13
Environmental problems	-.06	3	0
<i>Intended use</i>			
Hold for investment	-.17	15	0
Public use	.12	1	8
Open space	-.33	13	1
Unknown	-.09	13	0
Sold as part of expansion plan	-.13	8	0

Results: Residential Land

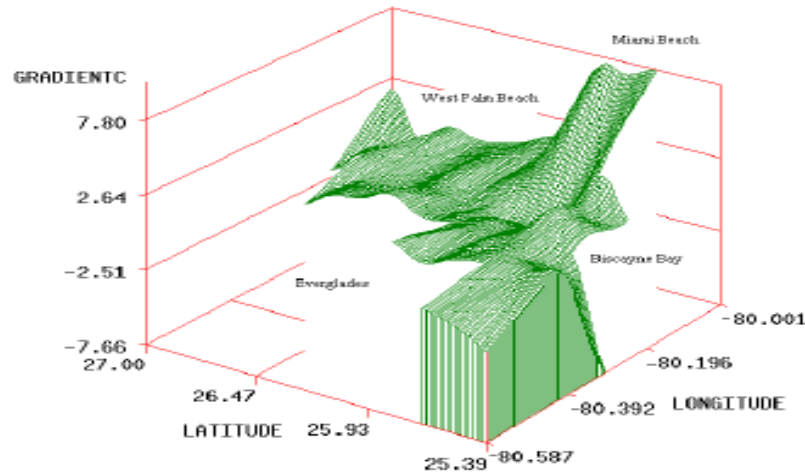
Variable	Median coefficient	# Significant	
		Negative	Positive
Log of parcel size	-.53	23	0
<i>Type of property</i>			
Single-family	-.08	9	2
Multifamily rental	.17	1	12
Other residential	-.28	12	1
<i>Condition of property</i>			
Graded	.18	0	17
Paved	.25	0	6
Finished	.38	0	22
Fully improved	.29	0	11
Platted and engineered	.29	0	7
Previously developed	.21	0	14
Improvements unknown	.02	4	6
Structure present	.05	0	7
Environmental problems	.14	0	0
<i>Intended use</i>			
Hold for investment	-.21	14	0
Public use	-.02	2	2
Open space	-.32	12	0
Unknown	-.08	9	1
Sold as part of expansion plan	-.08	2	0

Results: Locational Effects

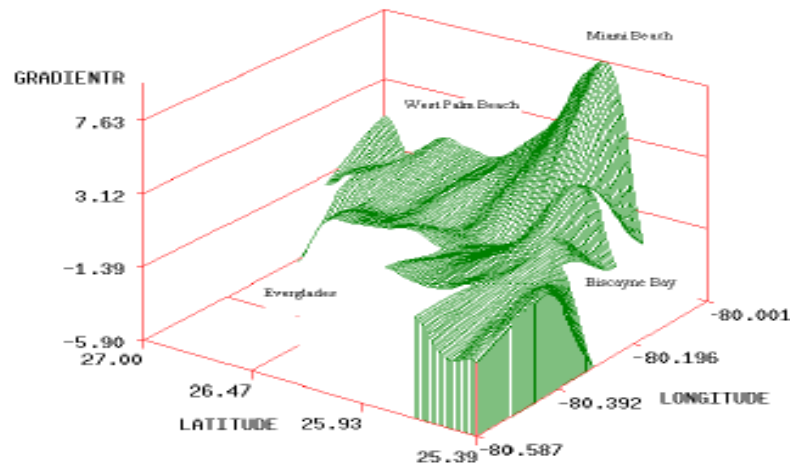
- Distance from CBD is an important feature of land prices
 - Coefficient is negative and significant in about half of the MSAs; positive and significant in several others.
 - Distance gradient in median MSA: -0.14 for commercial land and -0.25 for residential land.
- However, distance from CBD does not fully characterize location effects
 - For commercial land, about $\frac{3}{4}$ of MSAs have at least 10 significant grid vertices.
 - Same result holds for residential land.

Estimated Grid for South Florida

Commercial

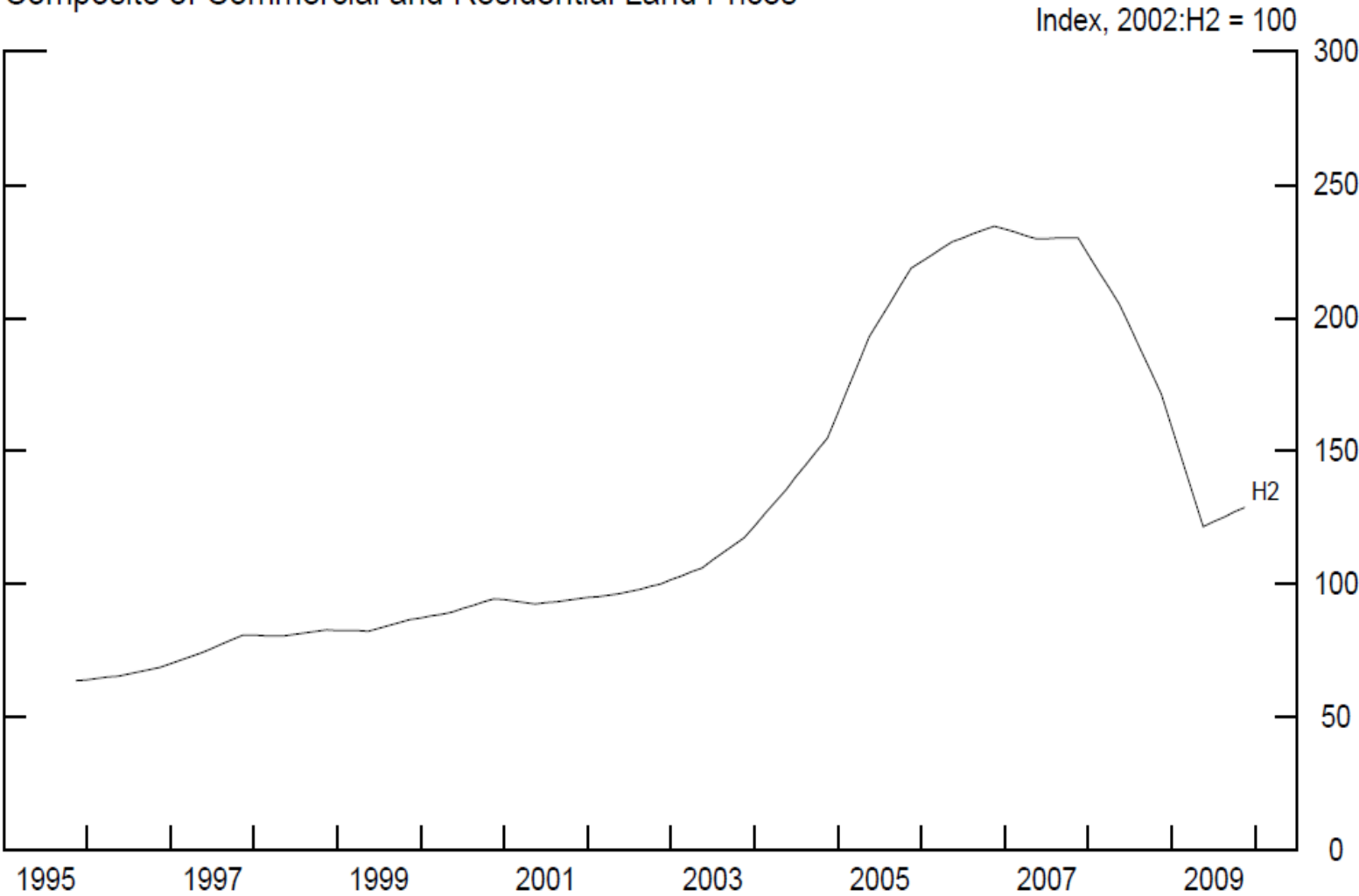


Residential



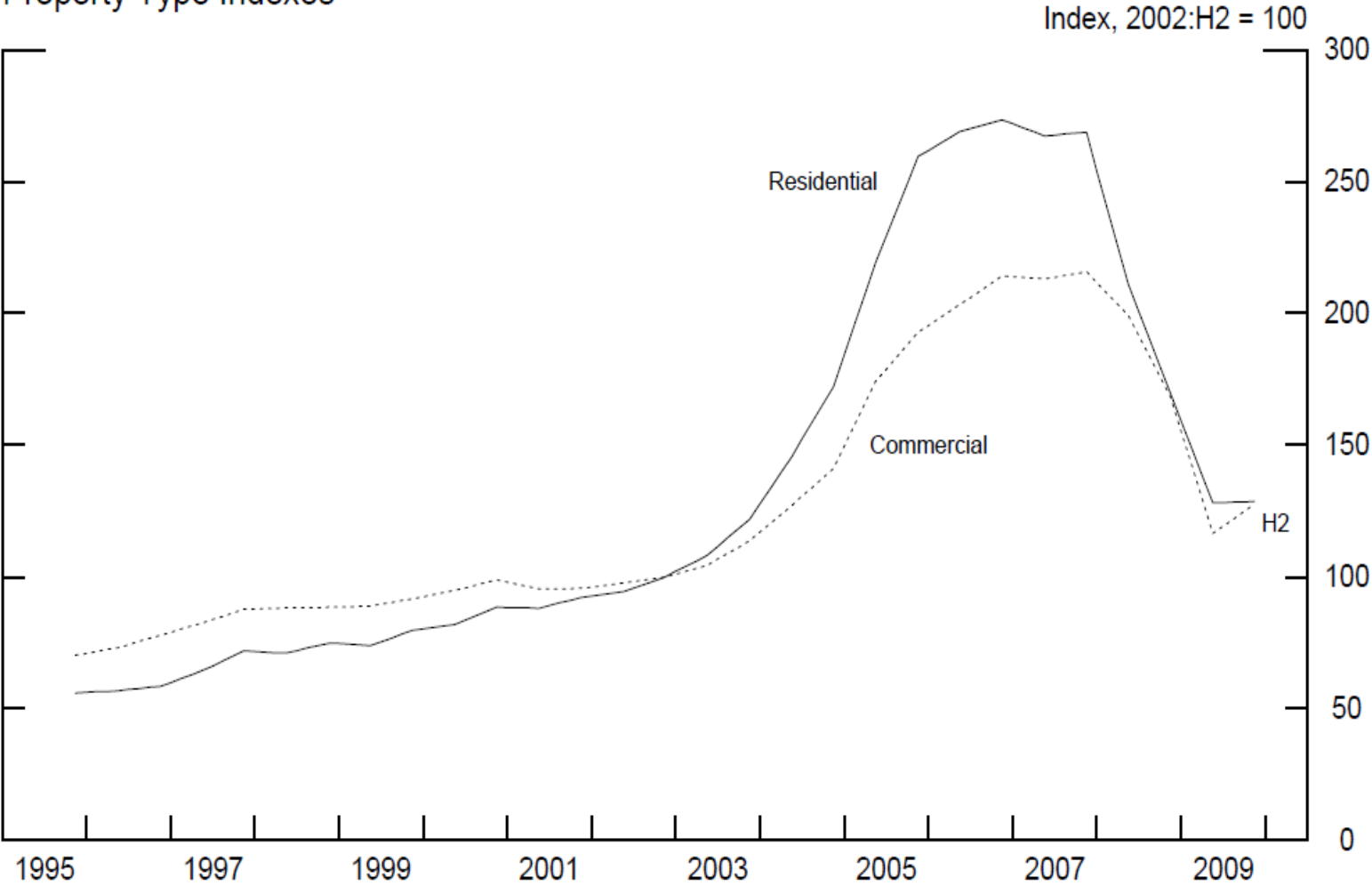
National CRE Land Price Index

Composite of Commercial and Residential Land Prices

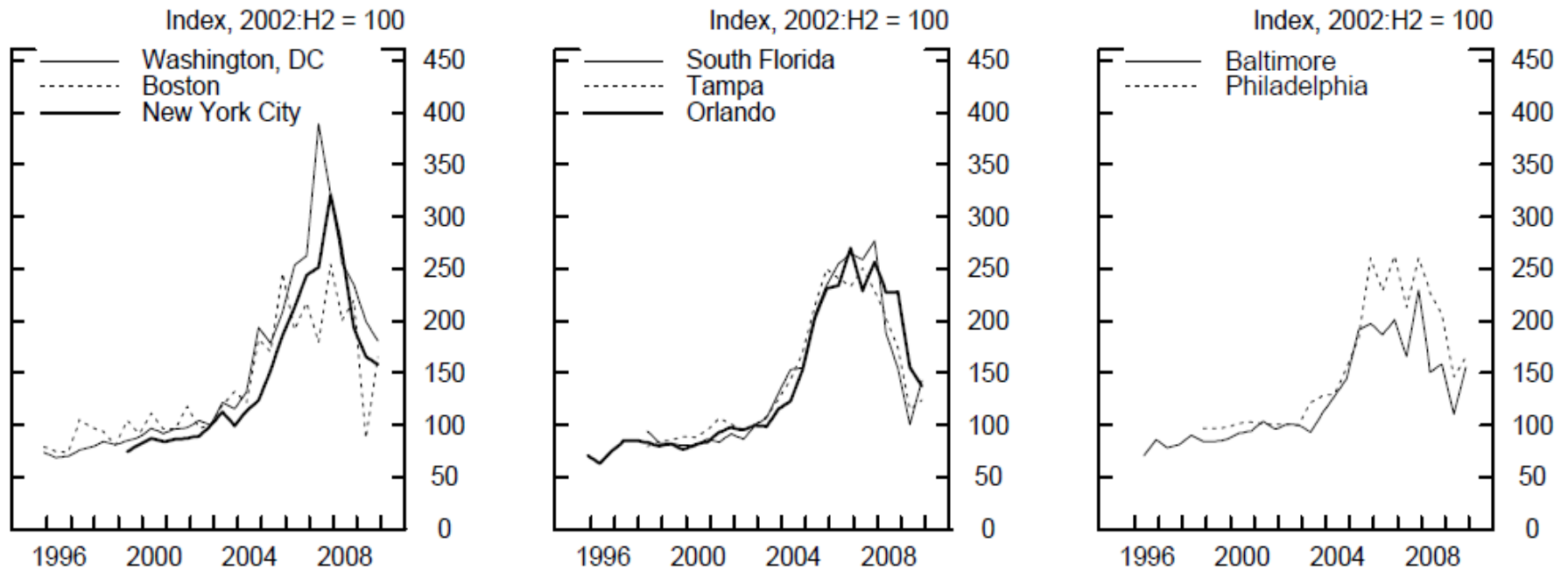


National CRE Land Price Indexes

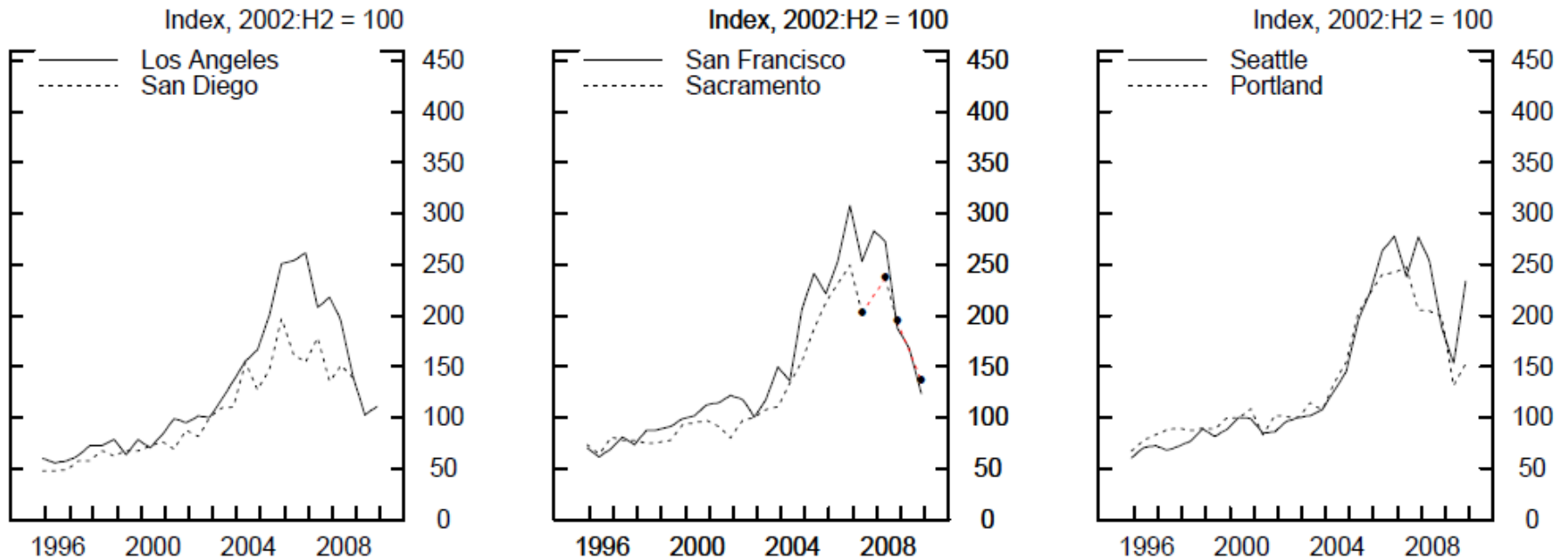
Property Type Indexes



Aggregate Land Price Indexes on the East Coast

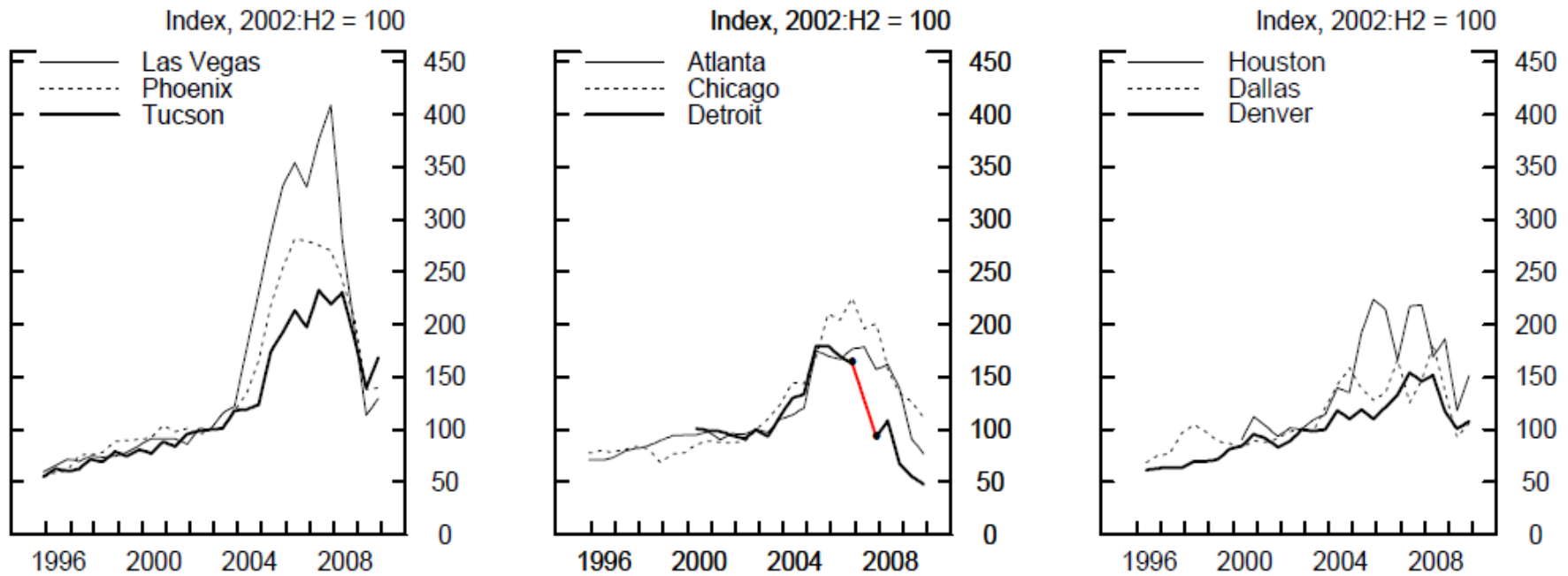


Aggregate Land Price Indexes on the West Coast



Note. Red segments between dots represent interpolation for missing half-yearly estimates.

Aggregate Land Price Indexes in the Midwest, South, and West



Note. Red segments between dots represent interpolation for missing half-yearly estimates.

Changes in Aggregate Land Prices, Selected MSAs

MSA	Date of		Percent change		Price level at low, 2002:H2=100
	Peak	Post-peak low	2002:H2 to peak	Peak to low	
Atlanta	2007:H1	2009:H2	79	-57	77
Dallas	2006:H2	2009:H1	82	-49	93
Denver	2007:H1	2009:H2	54	-35	100
Houston	2005:H2	2009:H1	124	-47	119
Las Vegas	2007:H2	2009:H1	309	-72	115
New York	2007:H2	2009:H2	221	-51	157
Phoenix	2006:H1	2009:H1	182	-51	138
San Francisco	2006:H2	2009:H2	208	-60	123
South Florida	2007:H1	2009:H2	177	-64	100
Washington DC	2007:H1	2009:H2	289	-53	183
Median across all MSAs	2006:H2	2009:H1	150	-51	123

Changes in Commercial Land Prices, Selected MSAs

MSA	Date of		Percent change		Price level at low, 2002:H2=100
	Peak	Post-peak low	2002:H2 to peak	Peak to low	
Atlanta	2007:H1	2009:H2	78	-55	80
Dallas	2006:H2	2009:H1	66	-43	95
Denver	2007:H1	2009:H2	63	-32	111
Houston	2006:H1	2009:H2	110	-44	118
Las Vegas	2007:H2	2009:H1	293	-76	94
New York	2007:H2	2009:H1	178	-45	153
Phoenix	2007:H2	2009:H2	133	-47	123
San Francisco	2008:H1	2009:H1	137	-59	97
South Florida	2007:H2	2009:H1	218	-63	118
Washington DC	2007:H1	2009:H2	210	-54	143
Median across all MSAs	2007:H1	2009:H2	137	-48	123

Changes in Residential Land Prices, Selected MSAs

MSA	Date of		Percent change		Price level at low, 2002:H2=100
	Peak	Post-peak low	2002:H2 to peak	Peak to low	
Atlanta	2006:H1	2009:H2	91	-63	80
Dallas	NA	NA	NA	NA	NA
Denver	2007:H2	2009:H2	51	-29	111
Houston	NA	NA	NA	NA	NA
Las Vegas	2007:H1	2009:H2	337	-69	135
New York	2007:H2	2009:H2	328	-68	137
Phoenix	2006:H2	2009:H1	292	-63	145
San Francisco	2006:H2	2009:H2	254	-67	117
South Florida	2006:H1	2009:H1	208	-77	71
Washington DC	2006:H2	2009:H2	198	-47	158
Median across all MSAs	2006:H2	2009:H2	195	-63	110

Comparing Land Prices to Real Estate Prices

Index	Date of		Percent change	
	Peak	Post-peak low	2002:H2 to peak	Peak to low
<i>Commercial</i>				
Land price index	2007:H2	2009:H1	115	-46
CoStar commercial repeat sales index	2007:H2	2009:H2	70	-26
<i>Residential</i>				
Land price index	2006:H2	2009:H1	169	-52
S&P/Case-Shiller 20-city home price index	2006:H1	2009:H1	56	-30

Future Work

- Analyze economic and financial factors behind movements in land prices.
- Use CoStar data to construct price indexes for commercial real estate for U.S. and individual MSAs.
- Conduct more rigorous comparison of commercial land prices and commercial real estate prices.
- Estimate share of real estate value attributable to land.