Does an Economic Downturn Crowd Out Concern for the Environment?

Evidence from a Water Quality Hedonic Property Value Model during the South Florida Housing Market Collapse

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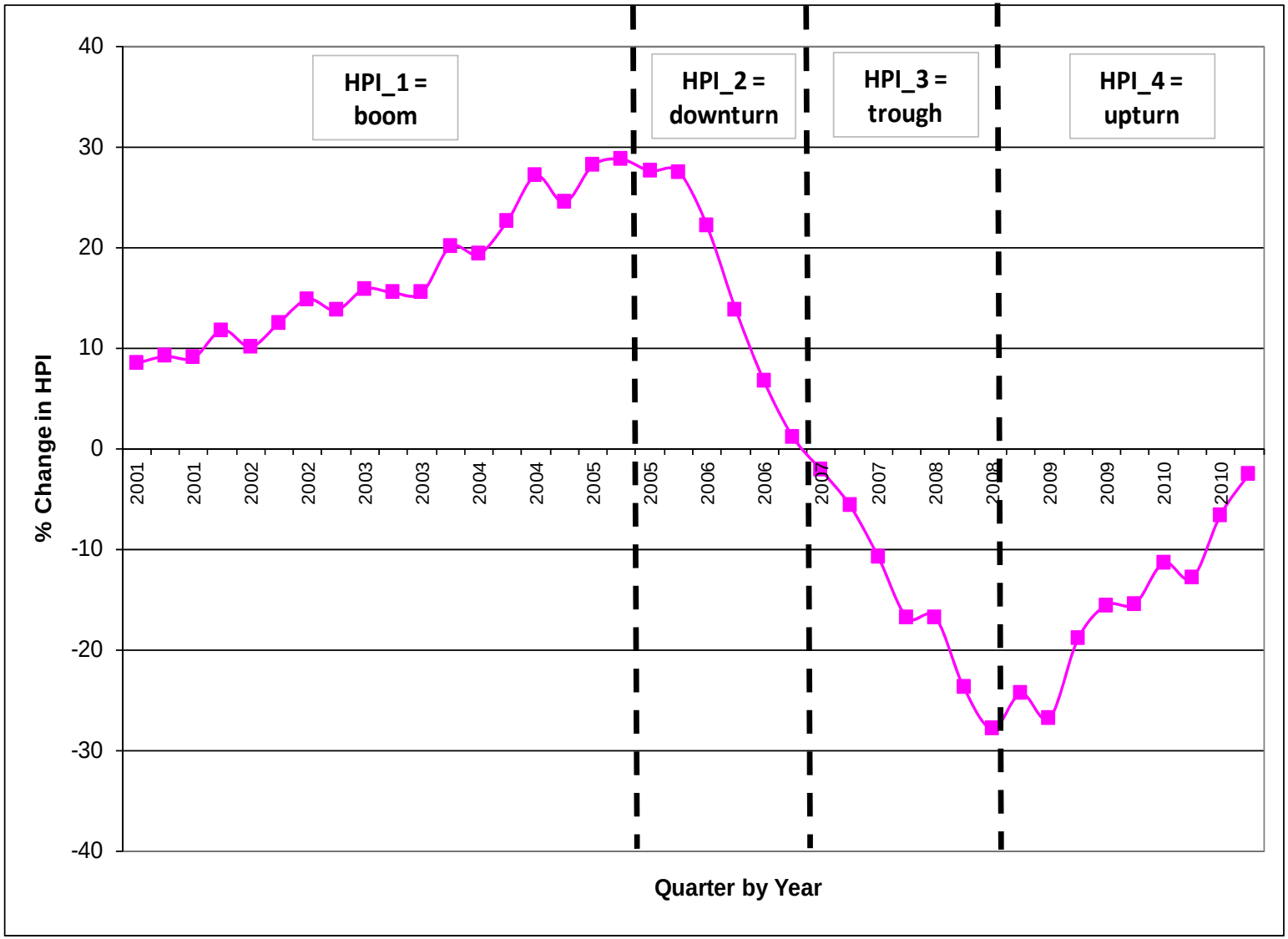
Housing Market Fluctuations

- Between 2000 and 2006, many areas of the U.S. experienced a housing boom
  - Some metropolitan areas having nearly 40% of their existing housing stock being built during this time period (Gabe and Florida, 2011)
  - Average U.S. housing prices rising by more than 54% (Cho et al., 2011).
- The real estate boom turned to bust driven by the sub-prime mortgage crisis and ultimately an economic recession beginning in 2007
  - Housing values falling between 25 and 50 percent in 25 of the top 100 largest U.S. metropolitan areas (Gabe and Florida, 2011).
  - The real estate boom and bust was especially pointed in the state of Florida.

Housing Market Fluctuations in Florida

- The highest shares of housing units constructed from 2000 to 2006 in 7 of the top 25 metropolitan areas (Gabe and Florida, 2011)
- The average housing price increased more than 90% between 2000 and 2006 (Labonte, 2007)
- These metropolitan areas also experienced some of the most severe declines in housing prices from 2007 to 2010 (Gabe and Florida, 2011)

Housing Market Fluctuations



Unemployment Rate Fluctuations

Water Quality Hedonics

- Hedonic property value models provide an intuitive analytical tool for examining whether a relationship exists between an environmental amenity and housing prices (Rosen, 1976).

- Earlier studies considered water quality levels in the hedonic model, and related these to the willingness to pay for water quality attributes (Bin and Czajkowski, 2011; Leggett and Bockstael, 2000; Walsh et al., 2011).

- Recent studies suggest that the implicit prices for environmental quality can vary over time, especially given substantial changes to the underlying (assumed) housing market equilibrium (Carruthers et al., 2010).

Competing Hypotheses

- There is evidence that recessions crowd out concern for the environment (Kahn and Kotchen, 2010; Cho et al. 2011), and therefore potentially result in lower implicit prices.

- There are also competing hypotheses whereby the impact of recessions is reflected in higher implicit prices in some housing market settings (Elliot et al., 1997).

- This study attempts to provide empirical evidence to make an assessment of the effects of housing market conditions on the implicit prices of water quality.

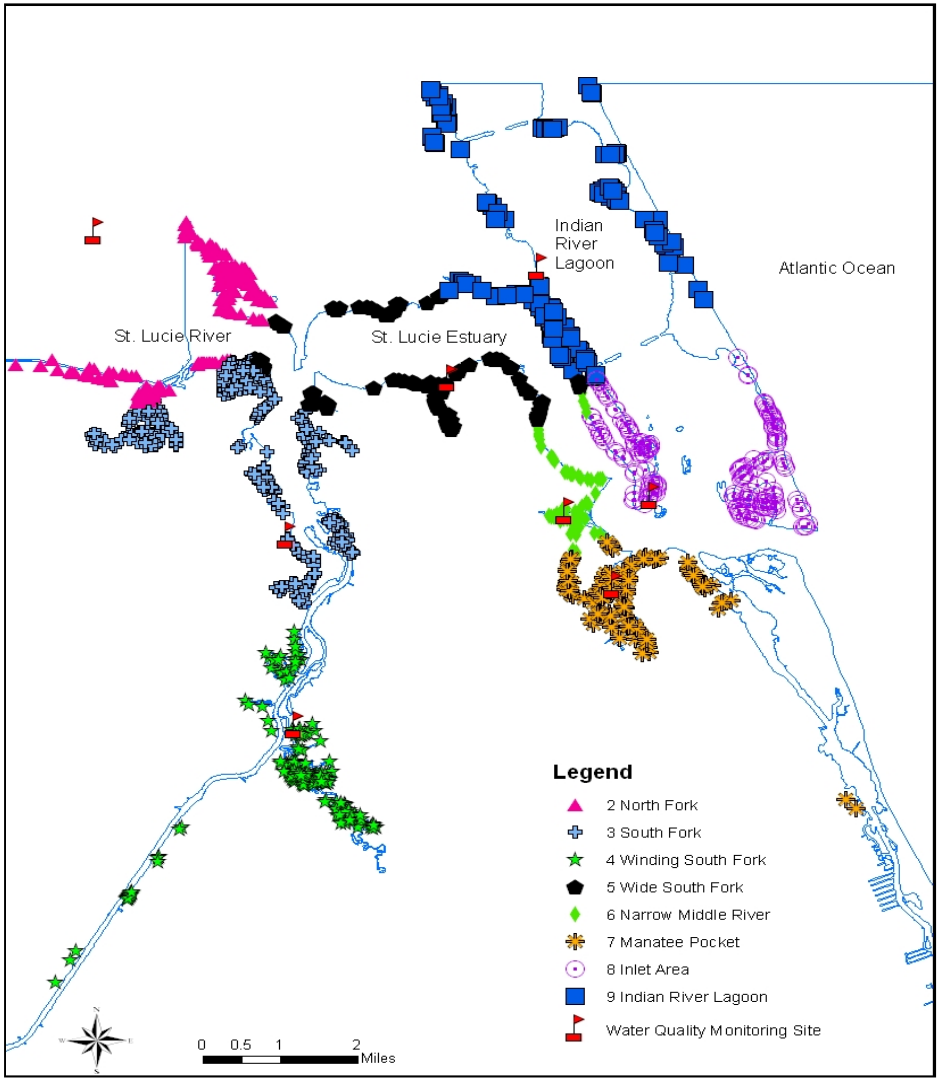
Study Area

- Martin County is located on the Southeastern Atlantic coast of Florida - waterfront housing market located on the St. Lucie River, St. Lucie Estuary, and Indian River Lagoon.

- This area is well-suited for a hedonic analysis of water quality due to the large number of waterfront properties, the lively housing market, as well as the variation in water quality.

- Water quality matters to homebuyers given that the health of these waterbodies are an integral part of the local history as well as the environmental and economic well-being of the community.

Study Area


Indian River Lagoon
Atlantic Ocean
St. Lucie River
St. Lucie Estuary
Legend
2 North Fork
3 South Fork
4 Winding South Fork
5 Wide South Fork
6 Narrow Middle River
7 Manatee Pocket
8 Inlet Area
9 Indian River Lagoon
Water Quality Monitoring Site
0 0.5 1 2
Miles

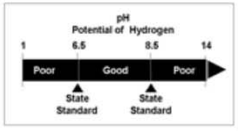
Water Quality Data

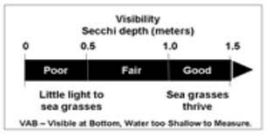
St. Lucie River Estuary
Water Quality Outlook

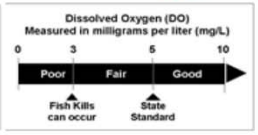
This information is provided by the Florida Oceanographic Society with support of the Marine Resources Council. It is collected by the Citizen Volunteer Water Quality Monitoring Network.
For complete data go to our website at:
http://www.floridaoceanographic.org/water.htm

Posted:	11/04/10		
Overall Grade:	90.6%	A-	IDEAL

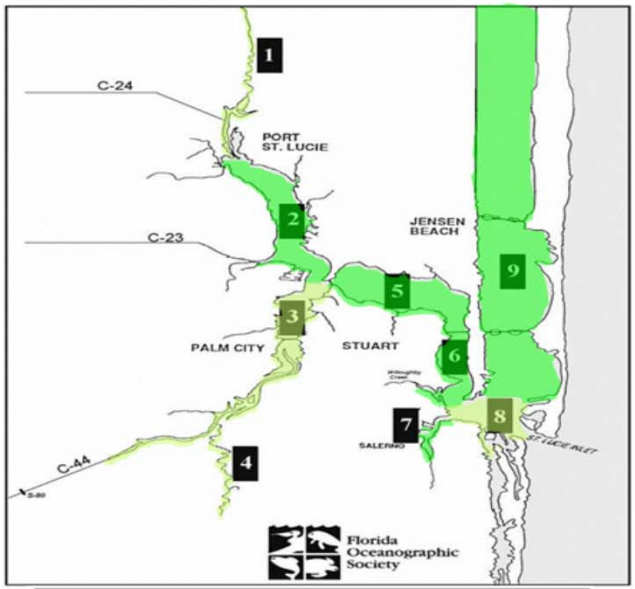
Zone/ Location	Water Temp. Deg. F	pH	Visibility (Secchi) Meters	Salinity ppt	Dissolved Oxygen mg/L	Location Score	Grade
1. Winding North Fork	77	7.7	0.90 Fair	2.0 Good	4.9 Fair	81%	B Good
2. North Fork	79	8.1	1.35 Good	16.0 Good	5.8 Good	97%	A Ideal
3. South Fork	73	8.0	0.65 Fair	19.0 Good	6.1 Good	87%	B Good
4. Winding South Fork	79	7.7	0.95 Fair	3.0 Good	4.1 Fair	81%	B Good
5. Wide Middle River	82	8.2	1.80 Good	20.0 Good	6.0 Good	97%	A Ideal
6. Narrow Middle River	82	8.5	1.85 Good	29.5 Good	7.3 Good	97%	A Ideal
7. Manatee Pocket	79	8.0	1.10 Good	30.0 Good	5.8 Good	97%	A Ideal
8. Inlet Area	80	8.4	0.70 Fair	31.0 Good	4.5 Fair	81%	B Good
9. IRL	73	8.1	1.60 Good	38.0 Good	5.3 Good	97%	A Ideal







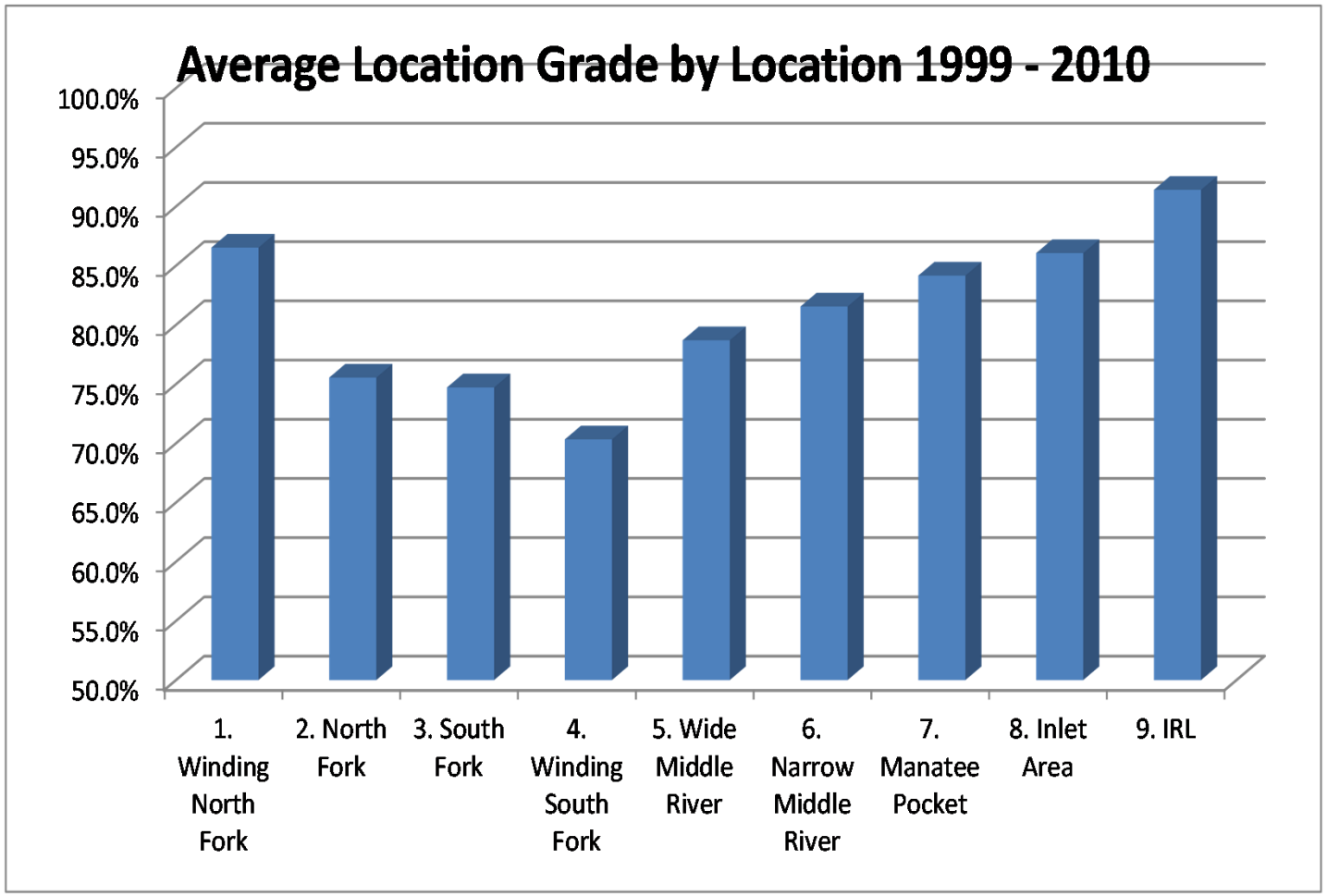
Comment: The data above may indicate areas of concern in the St. Lucie Estuary. Citizens should call the Florida Department of Environmental Protection (DEP) at 871-7662 or the South Florida Water Management District (SFWMD) 223-2600 to ask about the quality of a specific area and report observations of pollution.



Grading				
A	B	C	D	F
90-100	80-89	70-79	60-69	0-59
IDEAL	GOOD	SATISFACTORY	POOR	DESTRUCTIVE

Salinity (Parts per Thousand)				
Zones	Description	Good	Fair	Poor
1 & 4	Winding North & South Forks	2 to 8	1 to 2 or 8 to 15	< 1 or > 15
2 & 3	Inner St. Lucie Estuary (North & South Fork)	15 to 25	10 to 15 or > 25	< 10
5	Wide Middle St. Lucie River	> 20	15 to 20	< 15
6	Narrow Middle St. Lucie River	> 25	20 to 25	< 20
7	Manatee Pocket	> 27.5	20 to 27.5	< 20
8 & 9	Inlet and Indian River Lagoon (to Jensen Beach Causeway)	>30	25 to 30	< 25

Water Quality Data



Data

Variable	Decription	Mean	Std dev
House Price	Sale price adjusted to 2010 by the housing price index	$ 954,732	$ 959,005
	Time Interval		
HPI_1	Equal 1 if the house was sold during Jan/2001-Jun/2005, 0 otherwise	0.52	0.50
HPI_2	Equal 1 if the house was sold during Jul/2005-Dec/2006, 0 otherwise	0.13	0.34
HPI_3	Equal 1 if the house was sold during Jan/2007-Sept/2008, 0 otherwise	0.19	0.39
HPI_4	Equal 1 if the house was sold during Oct/2008-Dec/2010, 0 otherwsie	0.16	0.37
	Water Quality Variables		
Water Quality	Score of water quality in nearby testing site (%)	76.72	10.17
	Structural Variables		
Bedroom	Number of bedroom	3.2	1.0
Bathroom	Number of bathroom	2.5	1.1
Footage	Total footage of house (sqaure feet)	2982	1722
Age	Number of year house was built, subtracted from the year of house's recent sale	22.1	15.8
AC	Dummy variable for AC house (1 if AC, 0 otherwise)	1.0	0.1
Masonry	Dummy variable for masonry house (1 if masonry, 0 otherwise)	0.4	0.5
Storage	Number of Stories of the house	1.4	0.6
	Location Variables		
Distance	Distance to the nearest water testing zone (in feet)	7566	4262
River	Dummy varialbe for house near river (1 if near river, 0 otherwise)	0.61	0.49
Estuary	Dummy variable for house near estuary (1 if near estuary, 0 otherwise)	0.10	0.30
Inlet	Dummy variable for house near inlet (1 if near inlet, 0 otherwise)	0.29	0.45
	Neigborhood Variables		
Housing Density	Housing density for census-block group in 2000 (per acre)	1.34	1.52
Senior	Population of senior citizens (65 years and over) for census-block group in 2000	49.93	71.59
Rent Rate	Rental rate for census-block group in 2000 (%)	8.72	20.83
Vacancy Rate	Vacancy rate for census-block group in 2000 (%)	0.14	0.15

Note: The total number of observations is 1164.

A Spatial Error Hedonic Model

- Regression diagnostics based on Ordinary Least Squares (OLS) estimation and the Lagrange Multiplier (LM) test statistics suggest the first-order spatial error hedonic model:

$$ln\,P = \alpha + \sum_i \beta_i s_i + \sum_j \gamma_j n_j + \sum_k \phi_k w_k + \varepsilon$$

$$\varepsilon = \lambda \Pi \varepsilon + u,$$

- The spatial autoregressive error models are estimated via maximum likelihood (ML).

Results

Spatial Error Model		
Variable	*Estimated Coeff.*	*Standard Error*
CONSTANT	9.6378***	0.4628
Time Interval		
HPI_2	0.4169	0.3397
HPI_3	-1.0771**	0.5244
HPI_4	-1.5116***	0.5692
Water Quality Variables		
Water Quality (WQ)	0.0009	0.0025
WQ*HP_2	-0.0016	0.0045
WQ*HP_3	0.0152**	0.0067
WQ*HP_4	0.0166**	0.0071
Structural Variables		
Bedroom	0.0574**	0.0264
Bathroom	0.1058***	0.0202
Log(Footage)	0.4043**	0.0528
Log(Age)	-0.0090	0.0066
AC	0.1618	0.1880
Masonry	0.1334***	0.0425
Storage	0.0180	0.0370
Location Variables		
Log(distance)	-0.0252	0.0236
Estuary	-0.0393	0.0675
Inlet	-0.0343	0.0530
Neigborhood Variables		
House Density	-0.0261*	0.0148
Senior	-0.0008	0.0005
Rent Rate	-0.0019	0.0020
Vacancy Rate	1.1636***	0.1729
LAMBDA	0.3045***	0.0323
R-squared	0.5013	

Note: * means that the estimation is significant at 10%;
** means that the estimation is significant at 5%;
*** means that the estimation is significant at 1%.

Results

	95% Lower Bound	Mean WTP	95% Upper Bound
Jan/2001-Jun/2005	-$485.45	$109.96	$697.55
Jul/2005-Dec/2006	-$1,506.50	-$103.71	$1,318.59
Jan/2007-Sept/2008	$327.06	$2,204.20	$4,005.62
Oct/2008-Dec/2010	$332.44	$1,613.82	$2,922.69

Notes: The marginal willingness to pay is evaluated at the observed mean values. A marginal change in GRADE is defined as a 10 percentage point increase. A bootstrapping procedure is used to generate 90% confidence intervals for the marginal willingness to pay (Krinsky and Robb 1986). The reported confidence intervals are based on 5,000 sets of random parameter vectors from the distribution of the estimated parameters.

Conclusions

- We analyze Martin County Florida waterfront home sales over a ten year time period from 2001 to 2010 during the South Florida real estate market boom and bust.
- We account for the real estate boom and bust effect by partitioning the market into its four distinct time segments.
- During the worst of the housing market bust and its associated upturn the value of improved water quality becomes more important to homebuyers.
- Our result negates the notion that the corresponding recession crowded out concern for the environmental amenity of water quality.