Applying the Hedonic Pricing Model to the Prices of Single-Family Homes in the Oldest U.S. City, St. Augustine, Florida, Testing Whether Property Taxes Are Capitalized into Housing Prices

Angjellari-Dajci, Fiorentina and Cebula, Richard

Jacksonville University, Jacksonville University

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Fiorentina Angjellari-Dajci
and
Richard Cebula

Abstract. This empirical investigation applies a hedonic pricing model to determine whether, in the spirit of Tiebout (1956), Oates (1969), and Tullock (1971), property taxes have been capitalized into housing prices of single-family homes in city of St. Augustine, Florida housing market for single family homes. There were sufficient data in this context to study a total of 4,017 single-family houses for the six-year period from 2008 to 2013 period. The sales price and property tax levels are expressed real terms, i.e., in 2005 dollars. The semi-log estimation reveals, among other things, that the natural log of the *real* sales price of a single-family house in the St. Augustine area was in fact negatively affected by the city and county property tax level.

Keywords: Housing prices; Property tax capitalization; Market mechanism

JEL classifications: R14; R13; R11

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1. Introduction

Over the last quarter century, hedonic pricing models have been used in a number of studies to assess the impacts of historic district designation, housing traits, environmental forces, and/or other factors on property values of one form or another (Coffin, 1989; Ford, 1989; Garrod and Willis, 1992; Hughes and Sirmans, 1992; Asabere and Huffman, 1994; Decker, Nielson, and Sindt, 2005; Cebula, 2009; LaCour-Little and Malpezzi, 2009). Several studies use hedonic pricing models to assess the impacts of historic district designation and other factors on the sale price of residential properties (Coffin 1989; Ford 1989; Asabere and Huffman 1994; Asabere et al. 1994; Clark and Herrin 1997; Coulson and Leichenko 2001; Sirmans et al. 2005; Cebula 2009B, and Coombs et al. 2012).

The present study seeks to extend the latter literature by applying the hedonic pricing model to the prices of single-family homes in the oldest city in the U.S., the city of St. Augustine, Florida, a city which heretofore has not been formally studied, with an emphasis on the question of *whether property taxes have been capitalized into housing prices* in St. Augustine. This study also assesses the impact of *historic district designation* on the real price of single-family homes in the city. The study pursues these two objectives by incorporating not only a property tax rate variable for each single-family home sold over the study period but also by creating seven binary variables to reflect whether a home sale involved a building officially designated as a national register historic designation. Moreover, the analysis is conducted within the context of a number of other factors potentially influencing the housing market, factors commonly included in hedonic pricing models, such as a series of interior, exterior characteristics, community features, and spatial considerations.

In the next section, the theoretical framework is provided, along with the empirical model. Next, a description of the data is provided. Following conventional practice in the literature, the model is estimated in semi-log form. The results are provided and analyzed in the subsequent section of this study. The conclusion section provides a summary of the principal results.

2. Theoretical Model/Framework

In this section of the study, the framework within which the hedonic pricing model is applied to housing sales in the City of St. Augustine, Florida, is provided. Tiebout (1956,

p. 418) hypothesized that "...the consumer-voter may be viewed as picking that community which best satisfies his set of preferences for public goods...the consumer-voter moves to that community whose local government best satisfies his set of preferences..." Furthermore, as Tullock (1971, p. 917) further observes, this hypothesis can be extended such it more clearly stresses that, *ceteris paribus,* the "...individual deciding where to live will take into account the private effects upon himself of the bundle of government services and taxes..." Hence, Tullock (1971), arguably more explicitly than Tiebout (1956), emphasizes that the consumer-voter evaluates the tax burden at potential locations of choice. Following in principle the analysis in Oates (1969), a number of studies have investigated whether property taxes are capitalized into housing prices. The latter is the *primary*, although certainly not the only, focus of the present study.

The basic premise of the hedonic pricing model is that a house, in this case, a single-family house, constitutes a bundle of both desirable and undesirable attributes to utility-maximizing consumers, all of which contribute to the market value of the house, as revealed through a market transaction, i.e., the price of the home at closing. The hedonic pricing model decomposes the transaction price into various components such as interior and exterior features, or other traits of the house, such as community features, and location (i.e., spatial considerations) that affect the final sale price. The estimated parameters of the model provide information about the relative contribution of any given house feature.

In this study, the hedonic pricing model takes the following general form:

$lnRSPj = f(Ij, Ej, Oj)$

lnRSPj = the natural log of the *real* price of house j, where the price of the j^{th} house is expressed in 2005 dollars;

Ij = a vector of interior physical characteristics for house j;

Ej = a vector of external physical characteristics for house j; and

Oj = a vector of other factors associated with house j, including property taxes, spatial control variables, and historic district designation variables.

The present study applies the hedonic pricing model to home sales within the City of St. Augustine, Florida over the six-year period from 2008 through 2013. Data for 4,017 home sales for which there was sufficient information for analysis during this time frame in the City of St. Augustine were obtained from the St. Augustine and St. Johns County Board of Realtors' Multiple Listing Service (Dubin, 1998).

In order to permit comparison of sales prices across the study period, all housing prices and property taxes were converted to and expressed in 2005 dollars using the price index for single-family homes from the U.S. Census Bureau (2007, Table 710).

There were a variety of interior and exterior physical characteristics available for each house sold as well as other factors associated that were available and expressly included in the analysis. Naturally, for each of the impacts of the explanatory variables on housing price in the model, the expected sign is proffered in the discussion provided below under the assumption of *ceteris paribus.* Several of the explanatory variables are binary variables, so that they assume a value of 1 if they exhibit a trait in question and a value of 0 if they do not.

The interior physical characteristics of house j include the following: *BATHS,* the listed number of full baths; *HALFBATHS*, the number of half baths); *BEDROOMS,* the total number of listed bedrooms; *SQFTFIN,* the total listed number of square feet of finished interior living space; *WOODFLOOR*, whether the house has hardwood floors, *FIREPLACE*, whether the house has any fireplaces, *CATHCEIL*, whether the house has a cathedral ceiling, and *BEDDWNST*, whether the house has one bedroom downstairs (for houses with 2 or more floors).

As observed in Sirmans, Macpherson and Zeitz (2005) and Boyle and Kiel (2001), and based on a variety of other studies, including Leichenko, Coulson and Listokin (2001), Laurice and Bhattacharya (2005), Decker, Nielsen and Sindt (2005), Coulson and Lahr (2005), and Cebula (2009), the real sales price (*RSALESPR*) of house j is expected to be an increasing function of the number of desirable internal and external physical housing characteristics. For example, *RSALESPR* is expected to be an increasing function of square footage of finished living space, the number of bathrooms and presence of fireplaces.

The exterior physical characteristics of house j include the following: *STORIES,* the *number* of stories in the house structure; *BRICK* (=1 or 0), whether the exterior is made principally of brick; *STUCCO* (=1 or 0), whether the house exterior is principally of stucco construction; *GARAGES* the *number* of attached or detached garage spaces that are included as part of the house; *OTHERSQFT*, the total listed number of square feet of other space, such as enclosed porch, or garage area (look for correlation on garage and othersqft); *STYLE*, the construction style of the house (Spanish, contemporary, craftsman, patio …. etc see my notes); *SPRINKLER* (=1 or 0), whether the house has an automatic sprinkler system; *ROOFMTL* (=1 or 0), whether the house has a MTL type of roof; *ROOFTILE* (=1 or 0), whether the house has tile roof (as opposed to shingles); *FENCE* (=1 or 0), whether the house has a fence; *WHLCHRACS* (=1 or 0), whether the house has wheelchair access; *PRIVATEPOOL* (=1 or 0), whether the house has a private pool; *INSULWND* (=1 or 0), whether the house has insulated windows. The RSALESPR of house j is expected to be an increasing function of all the above characteristics, except *STYLE*, for which we had no prior research results to compare it to.

Community features constitute an additional subset of exterior physical characteristics, which include: *HOA* (=1 or 0), whether the house has a homeowners association; *CLUBHOUSE* (=1 or 0), whether the house has a club house; BEACHACS (=1 or 0), whether the house has beach access; COMPOOL (=1 or 0), whether the house has a community pool; TENNIS (=1 or 0), whether the house has a tennis court; BULKHEAD (=1 or 0), whether the house has a bulk head, and GATED (=1 or 0), whether the house is part of a gated community.

Given that the presence of community features is related to additional costs homeowners have to pay (i.e., HOA fees), arguably, it would be somehow capitalized into the real price of house j. For families who use the community pool, the presence of such a pool commends a higher sales price. Same hypothesis can be made for beach access, or the sense of security derived by a gated community. Thus we are hypothesizing that at the extent that some community features are used extensively and enjoyed by the majority of homeowners, or considered advantageous in the event of a future re-sale, they are capitalized into housing prices, such that housing prices are expected to be an increasing function of these community features, ceteris paribus. On the other hand, to the extent that a considerable number of homeowners do not use, and thus derive no value from use of a tennis court, or golf course, or the clubhouse, having to pay HOA fees for amenities that they do not use are capitalized into housing prices, such that housing prices are expected to be a decreasing function of these community features, ceteris paribus.

Another factor associated with house j is AGE, the number of years since construction. As older homes may have higher likelihood of needing repair and more imperfectly match modern preferences, and as suggested in Sirman et al (2005), Clark and Herrin (1997), Decker et al (2005) and Laurice and Bhattacharya (2005), the age of a house is expected to adversely influence its sales price.

In addition, there is the residual category of other factors considered in this study. In the spirit of the Tiebout hypothesis, there is the property tax variable, *TXRATEj,* which is defined as the annual city plus county property tax liability associated with house j, divided by the sales price and multiplied by 100. This study hypothesizes, in the spirit of the Tiebout (1956) hypothesis, as well as Tullock (1971) and Oates (1969), that residential property taxes are capitalized into housing prices such that housing prices are expected to be a decreasing function of property taxes, *ceteris paribus.*

There are three spatial control variables included in the model. It is hypothesized that

houses that are located on a corner, *CORNER* (=1 or 0), or CUL-DE-SAC (=1 or 0), may be more appealing and hence command a higher price. In addition waterfront houses, WATERFRONT (=1 or 0) also command a higher price.

Given the historical culture of St. Augustine as the oldest city in the United States, that if a single family house has received designation as a national, or local historic district, it should command a higher market price to reflect an element of prestige associated with this location. We expect all of the seven binary variables representing the national historic districts in St. Augustine and all of the five binary variables representing the local historic districts will have a positive impact on house prices.

Last, given the higher number of single family houses sold by banks after a process of foreclosure, or as short sales during the period under study, we included binary variables BANKOWNED (=1 or 0) and SHORTSALE (=1 or 0) to capture the impact of these factors on the real sales price. We hypothesize that given banks motivation to clear their inventories, these variables will negatively impact house prices. In addition, based on the ease and more secure transaction represented by a cash purchase, it is hypothesized that CASH (=1 or 0) will negatively impact house prices (sellers are willing to accept a lower cash price offer to a higher financed purchase, especially if sellers (banks included) want to close fast.

Seasonal controls by quarter, Q1, Q2, Q3 and Q4 are included to control for seasonal effects. Likewise, yearly controls are present in the form of year fixed effects.

To account for proximity/designation of a house to one of the 12 elementary schools in the City of St. Augustine, each of them signaling a different "education quality" we created 12 binary variables indicating which elementary school a given house is supposed to send their elementary school aged children to.

Last, we included the following variables in our analysis: DOM, the number of days the property was listed in the MLS system prior to the closing date. We hypothesize that this variable should have a positive impact/effect on the house price reflecting seller's determination to demand a higher price by his/her willingness to wait for the buyer who is willing to pay such price. OWNEROCCUPIED, a binary variable indicating whether the house was occupied by the owner (as opposed to not being occupied, bank property or tenant occupied) prior to the sale. We hypothesize this binary will positively impact the real sales price.

To account for the level of marketing used to sell the property from the listing gent via the MLS system, we chose a proxy, the number of photos uploaded and available on MLS. We expect the higher the number of photos, more exposure the house will get in the market, and the higher the chances it will be sold at the listing price (as opposed to under the listing price).

3. The Data

The present study applies the hedonic pricing model to home sales within the City of St. Augustine over the six-year period from 2008 to 2013. Data for 4017 home sales for which there was sufficient information for analysis during this time frame in the City of St. Augustine were obtained from the St. Augustine and St. Johns County Board of Realtors' Multiple Listing Service. In order to permit comparison of sales prices across the study period, all housing prices and property taxes were converted to and expressed in 2005 dollars using the price index for single-family homes from the U.S. Census Bureau.

Our main source of data for definitions of national and local historic districts and maps was the most recent publication, "Architectural Guidelines for Historic Preservation", prepared by the Planning and Building Division of City of St. Augustine, Fourth Edition, October, 2011. Authors identified by street address those houses that met the boundary criteria for national and local historic district designations, so as to create seven national historic districts and five local historic districts binary variables.

The City of St. Augustine contains seven National Register Districts: 1) City of St. Augustine; 2) Abbott Tract; 3) Model Land Company; 4) Lincolnville; 5) North City; 6) Fullerwood Park; and 7) Nelmar Terrace. Map 1 depicts the boundaries of these National Register Districts. Within the 4018 sales for which sufficient data was available, a total of 182 houses between 2008-2013 were sales in national historic districts; 15 in The City of St. Augustine; 17 in Abbott Tract; 27 in Model Land Company; 74 in Lincolnville; 21 North City; 20 in Fullerwood Park; and 8 in Nelmar Terrace.

Through a nomination process initiated by the Historic St. Augustine Preservation Board, City of St. Augustine was designated a National Landmark National Register District in April 1970. Similarly, the designation for Abbott Tract and Model Land Company occurred in August 1983, and for Lincolnville in November 1991. Since North City, Fullerwood Park and Nelmar Terrace became national historic districts in October 2009, August 2010 and March 2011 respectively, the sale of a residential property was entered as historic district only if it had occurred after October 2009, August 2010 and March 2011 respectively. For example in Fullerwood Park, there were 5 sales that occurred from 2009-2013 on Bay View Dr., but only the two that occurred after Aug 2010 were included under the binary Fullerwood. Similarly, on East Park Ave only the 2 out of the 3 sales which occurred after Aug 2010 and were included. For Sylvan Dr. only 2 out of 4 sales were included, and for Fullerwood Dr., 6 out of 8 sales after Aug 2010 were included. On Rainey Ave, the only sale occurred in 6/30/2009, thus was not included. In North City, from 4 sales on Cincinnati Ave, only the 3 that occurred after Oct 2009 were included. In Nelmar Terrace, on May St. only 1 out of 3 sales that occurred after March 11 were included.

The City of St. Augustine has created five Historic Preservation (HP) zoning districts to enhance and preserve significant historic buildings, objects, sites and structures, as well as important cultural resources. These districts serve to protect the architectural legacy, cultural heritage and built environment through education, planning and implementation of architectural guidelines. Map 2 depicts the boundaries of these locally designated Historic Preservation zoning districts.

Given that our data set contained only 11 sales in HP1, 1 sale in HP2 and HP4, 4 sales in HP5, and no sales in HP3, given the small number of observations (and confirmed from the insignificance of our coefficients in the regression analysis), we did not separately account for local historic districts in this study. Given that HP1, HP2 and HP3 are included in City of St. Augustine national register historic district, and HP4 is included in Model Land and Company and most of the HP5 included in North City our choice to not include these binaries in our estimations made sense. Descriptions of the variables in the analysis are provided in Table 1, whereas descriptive statistics are provided in Table 2.

Table 1. Definitions of the Variables

lnRSPR = the natural log of the sales price of house j expressed in 2005 dollars

SQFTFIN = the total number of square feet of finished living space in house j

STORIES = the number of stories/floors present in house j

FBATHS = the total number of full baths in house j

HBATHS = the total number of half baths in house j

BEDS = the total listed number of bedrooms in house j

BDDWNST = a binary variable indicating whether house j had one bedroom downstairs (=1 if yes)

CATHCEIL = a binary variable indicating whether house j had a cathedral ceiling (=1 if yes)

INSULWND = a binary variable indicating whether house j had insulated windows (=1 if yes)

FIREPLACE = a binary variable indicating whether house j had one or more fireplaces (= 1 if yes, = 0 otherwise)

BRICK = a binary variable indicating whether house j had a primarily or completely brick exterior (= 1 if yes, = 0 otherwise)

STUCCO = a binary variable indicating whether house j had a stucco exterior (=1 if yes)

DECK = a binary variable indicating whether house j had an exterior deck (=1 if yes)

GARAGES = the number of garages (not carports) that are part of house j

POOL = a binary variable indicating whether house j had its own swimming pool (=1 if yes)

SPRKL= a binary variable indicating whether house j had an automatic sprinkler system (=1 if yes)

NEW = a binary variable indicating whether house j was new at the time of sale (=1 if yes)

CORNER = a binary variable to indicate whether house j was located on a corner (=1 if yes)

CUL-DE-SAC = a binary variable to indicate whether house j was located on a cul-de-sac (=1 if yes)

HOA = a binary variable indicating whether house j was part of a homeowner's association (=1 if yes)

DOCK = a binary variable indicating whether house j had access to a dock (=1 if yes)

FENCE = a binary variable indicating whether house j had a partial or full fence (=1 if yes)

SKYLIGHTS

BULKHEAD

PROPTX = annual property tax (county plus city) for house j paid to city and county governments in 2005 dollars

TAXRT = tax rate of county and city taxes (defined as tax amount divided by sell price times 100) for house j

NHDIST = a binary variable indicating whether house j was designated as one of the seven National Register historic districts of the city of St. Augustine.

NHDIST = a binary variable indicating whether house j was designated one of the five local historic preservation districts of the city of St. Augustine.

Year Binaries
Y2008 = a binary variable = 1 if house was sold in year 2008
Y2009 = a binary variable = 1 if house was sold in year 2009
Y2010 = a binary variable = 1 if house was sold in year 2010
Y2011 = a binary variable = 1 if house was sold in year 2011
Y2012 = a binary variable = 1 if house was sold in year 2012
Y2013 = a binary variable = 1 if house was sold in year 2013

Quarterly sales binaries
Q1 = a binary variable = 1 if house was sold in first quarter (Jan-March)
Q2 = a binary variable = 1 if house was sold in first quarter (April-June)
Q1 = a binary variable = 1 if house was sold in first quarter (July-Sep)
Q1 = a binary variable = 1 if house was sold in first quarter (Oct-Dec)

Table 2: Descriptive Statistics

Variable	Description	Mean	Std. Dev.	Min	Max
sales_price	Sales price	236024.90	167110.50	10,000.00	2,200,000.00
Rsp	Real sales price	232090.10	164200.30	9,683.64	2,208,835.00
Lnrsp	Natural logarithm of rsp	12.16	0.63	9.1782	
list_price	List price	252717.60	186974.50	9900	
Dom	Days on market	167.61	164.53	0	
q1janmarch	First quarter	0.20	0.40	0	
q2apriljune	Second quarter	0.29	0.45	0	
q3julysept	Third quarter	0.25	0.43	0	
q4octdec	Fourth quarter	0.26	0.44	0	
y2013	Year 2013	0.26	0.44	0	
y2012	Year 2012	0.22	0.41	0	
y2011	Year 2011	0.18	0.38	0	
y2010	Year 2010	0.15	0.36	0	
y2009	Year 2009	0.13	0.33	0	
y2008	Year 2008	0.06	0.24	0	
Taxes	Taxes	2969.20	2,474.73	43	29,352.00
Rtaxes	Real taxes	2923.06	2,441.53	42.4301	29,499.50
Rtaxrate	Real tax rate	1.36	0.77	0.0449	
Stories	Number of stories	1.30	0.51	0	
Bedrooms	Number of bedrooms	3.24	0.83	1	
Baths	Number of bathrooms	2.19	0.69	1	
half_baths	Number of half bathrooms	0.22	0.43	0	
sqft_fin	Square feet of finished living space	1959.84	767.08	304	7,000
other_sqft	Other square feet	538.93	568.41	0	7,905
Garages	Number of garages	1.43	1.02	0	
Age	Age	24.14	24.63	0	
Agesq	Age squared	1189.06	2511.20	0	
agesq001	Age squared and divided by 100	11.89	25.11	0	
Yearbuilt	Year built	1988.86	24.63	1813	
new0_1	Built in current or previous year	0.05	0.23	0	
new0_2	Built in current or two previous years	0.08	0.27	0	
age0	Built in current year	0.02	0.12	0	
age1_5	One-five years old	0.11	0.32	0	
age6_10	Six-ten years old	0.27	0.44	0	
age11_20	11-20 years old	0.19	0.39	0	
age21_35	21-35 years old	0.20	0.40	0	
age36_60	36-60 years old	0.12	0.33	0	
age61_99	61-99 years old	0.06	0.25	0	
age100	100 or older	0.02	0.14	0	
Photos	Number of photos posted on MLS	12.91	7.63	0	
waterfront	Waterfront	0.15	0.36	0	
bankowned	Bank owned	0.17	0.38	0	

Shortsale	**Short sale**	0.13	0.33	0	
Cash	**Cash**	0.36	0.48	0	
Woodfloor	**Wood floor**	0.31	0.46	0	
stylespanish	**Spanish construction style**	0.23	0.42	0	
stylecontemp	**Contemporary construction style**	0.21	0.41	0	
stylecraftsman	**Craftsman construction style**	0.02	0.15	0	
Culdesac	**Cul-de-sac location**	0.10	0.29	0	
Corner	**Corner location**	0.11	0.31	0	
Stucco	**Stucco exterior finish**	0.43	0.49	0	
Brick	**Brick exterior finish**	0.07	0.25	0	
owneroccupied	**Owner-occupied**	0.31	0.46	0	
Sprinkler	**Automatic sprinkler system**	0.38	0.49	0	
Fireplace	**Fireplace**	0.27	0.44	0	
Hoa	**HOA**	0.18	0.39	0	
Bulkhead	**Bulkhead**	0.01	0.12	0	
Skylights	**Skylights**	0.01	0.12	0	
Clubhouse	**Clubhouse**	0.29	0.45	0	
Exercise	**Exercise room**	0.11	0.31	0	
Golf	**Golf course**	0.09	0.29	0	
Tennis	**Tennis court**	0.11	0.31	0	
Gated	**Gated community**	0.11	0.32	0	
Spa	**SPA**	0.00	0.05	0	
Unhpool	**Unheated pool**	0.14	0.35	0	
Hpool	**Heated pool**	0.02	0.12	0	
beachaccess	**Beach access**	0.03	0.18	0	
Rvparking	**RV/Boat parking**	0.03	0.16	0	
Roofmtl	**MTL roof**	0.06	0.25	0	
Rooftile	**Tile roof**	0.02	0.15	0	
Fencefull	**Full fence**	0.11	0.32	0	
Fencepart	**Partial fence**	0.09	0.28	0	
Cathceil	**Cathedral ceiling**	0.22	0.41	0	
Beddwnst	**Bedroom downstairs**	0.29	0.45	0	
privatepool	**Private pool**	0.04	0.20	0	
Insulwnd	**Insulated windows**	0.03	0.18	0	
Dock	**Dock**	0.03	0.16	0	
Whlchracs	**Wheelchair access**	0.00	0.03	0	
cele1	**Crookshank Elementary**	0.05	0.22	0	
kele1	**Ketterlinus Elementary**	0.07	0.26	0	
lele1	**Liberty Pines Elementary**	0.01	0.11	0	
mele1	**Mill Creek Elementary**	0.04	0.21	0	
osele1	**Osceola Elementary**	0.04	0.21	0	
otele1	**Otis A. Mason Elementary**	0.05	0.22	0	
rele1	**R.B. Hunt Elementary**	0.15	0.36	0	
sele1	**Southwoods Elementary**	0.01	0.11	0	
twele1	**The Webster School**	0.04	0.20	0	
tcele1	**Timberlin Creek Elementary**	0.02	0.13	0	
whele1	**W. D. Hartley Elementary**	0.14	0.34	0	
wcele1	**Wards Creek Elementary**	0.03	0.17	0	
north_city	**North City NHD**	0.01	0.07	0	
Fullerwood	**Fullerwood Park NHD**	0.00	0.07	0	

Nelmar	**Nelmar Terrace NHD**	0.00	0.04	0	
Citystaug	**City of St. Augustine**	0.00	0.06	0	
Abbott	**Abbott Tract**	0.00	0.06	0	
model_land	**Model Land Company**	0.01	0.08	0	
lincolnville	**Lincolnville**	0.02	0.13	0	
lhp1 (11)	**Local historic preservation HP1**	0.00	0.05	0	
lhp2 (1)	**Local historic preservation HP2**	0.00	0.02	0	
lhp3 (0)	**Local historic preservation HP3**	0.00	0.00	0	
lhp4 (1)	**Local historic preservation HP4**	0.00	0.02	0	
lhp5 (4)	**Local historic preservation HP5**	0.00	0.03	0	

4. Empirical Findings

This section presents the results of the estimated hedonic model described in the previous section. Following standard procedure, a semi-log specification was employed with LnRSP as the dependent variable and the White (1980) procedure adopted to correct for heteroskedasticity, with robust standard errors are shown in table below. The reader may be interested to know that numerous alternative versions of this specification yield a pattern of very consistent results, in terms of both coefficient size and t-value.

Table 3: OLS Regression Results

Basic Model,							
Lnrsp	**Coefficient**	**Robust Std. Error**	**t-value**				
constant	11.3963	0.03497	325.85				
sqft_fin	0.0003	0.00002	19.77				
Baths	0.0754	0.01271	5.93				
half_baths	0.0182	0.01623	1.12				
woodfloor	0.0604	0.01121	5.39				
fireplace	0.0745	0.01124	6.63				
cathceil	0.0473	0.01102	4.29				
stories	0.0642	0.01626	3.95				
other_sqft	0.0001	0.00001	4.62				
garages	0.0570	0.00642	8.88				
Age	-0.0023	0.00043	-5.35				
stylespanish	-0.0034	0.01113	-0.33				
stylecontemp	0.0398	0.01122	3.54				
Stucco	0.0447	0.01026	4.36				
Brick	0.0231	0.01751	1.32				
sprinkler	0.0414	0.01053	3.93				
roofmtl	0.1624	0.02870	5.66				
rooftile	0.2009	0.03162	6.35				
Fence	0.0418	0.01788	2.34				
privatepool	0.1396	0.02286	6.11				
insulwnd	0.0545	0.02113	2.58				
Hoa	-0.0010	0.01071	-0.09				
bulkhead	0.2688	0.05074	5.32				
clubhouse	-0.0252	0.01346	-1.87				
exercise	-0.0194	0.01540	-1.26				

Golf	-0.0431	0.01635	-2.63				
Tennis	0.0028	0.01443	0.19				
Gated	0.1057	0.01534	6.89				
Spa	0.1157	0.05449	2.12				
beachaccess	0.3461	0.03016	11.47				
rvparking	-0.0660	0.02388	-2.76				
rtaxrate	-0.1841	0.01048	-17.57				
waterfront	0.1843	0.01691	10.92				
culdesac	-0.0062	0.01336	-0.46				
corner	0.0262	0.01458	1.81				
citystaug	0.7434	0.09343	7.96				
abbott	0.4700	0.09872	4.76				
model_land	0.4845	0.06264	7.73				
lincolnville	0.0304	0.06191	0.49				
north_city	0.3914	0.07064	5.54				
fullerwood	0.2343	0.07948	2.95				
nelmar	0.2654	0.08873	2.99				
bankowned	-0.1144	0.01801	-6.35				
shortsale	-0.1225	0.01717	-7.14				
Cash	-0.0621	0.01088	-5.71				
Dom	0.0002	0.00005	4.62				
photos	0.0082	0.00077	10.66				
owneroccupied	0.0229	0.01079	2.12				
y2013	-0.2446	0.02297	-10.65				
y2012	-0.2735	0.02356	-11.61				
y2011	-0.2323	0.02282	-10.18				
y2010	-0.1170	0.02302	-5.08				
y2009	-0.0683	0.02313	-2.96				
y2008	(omitted)						
q1janmarch	0.0305	0.01430	2.13				
q2apriljune	0.0276	0.01259	2.19				
q3julysept	0.0227	0.01318	1.72				
q4octdec	(omitted)						
cele1	-0.1795	0.01973	-9.10				
kele1	0.1045	0.02559	4.08				
lele1	-0.0443	0.02428	-1.83				
mele1	-0.0663	0.02182	-3.04				
osele1	-0.1183	0.02240	-5.28				
otele1	-0.1602	0.02123	-7.55				
rele1	0.2280	0.01612	14.14				
sele1	-0.0615	0.03267	-1.88				
twele1	-0.1702	0.02235	-7.62				
tcele1	-0.0052	0.02732	-0.19				
whele1	0.0632	0.01721	3.67				
wcele1	-0.1459	0.02330	-6.26				

Number of obs	4017
F(67, 3949)	169.8
Prob > F	0
R^2	0.78
Adjusted R^2	0.

Among the 67 estimated coefficients shown in Table 3, 44 are statistically significant with the expected sign at the 1% level, nine are statistically significant with the expected sign at the 5% level, and five are statistically significant with the expected sign at the 10% level. The coefficient of determination indicates that 78% of the variation in the dependent variable was explained by the model, and the F-statistic is significant at the one percent level, serving evidence of the overall strength of the model.

Based upon the estimation in Table 3, the natural log of real sales price of single family houses in the city of St. Augustine is an increasing function of the following interior characteristics: the number of bathrooms, number of half bathrooms, number of square feet of finished living space in the house, presence of hardwood floors, a fireplace, a cathedral ceiling, a downstairs bedroom, and wheelchair access. The natural log of real sales price of single family houses in the city of St. Augustine is an increasing function of the following exterior characteristics: stories in structure, and the number of *other* square feet in the house, the number of garage spaces, contemporary construction style, stucco exterior finish, the presence of an automatic sprinkler system, a tile roof or an MLT roof, the presence of a fence, a private pool on the premises, insulated windows, and wheelchair access; and a negative, but not significant at even 10% level of Spanish construction style, and a negative and statistically significant at 1% level of the age of the house, as expected. This could be due to the fact that Spanish construction style is associated with older houses, and the contemporary style with newer ones.

In addition the following community features add positive value to the sales price: a gated community, beach access, a community pool, and bulkhead, while the following have a negative and statistically significant effect on the sale price: the presence of HOA itself, the presence of a clubhouse, or tennis court. When accounting for the net effect of beach access and gated community via the presence of the HOA, it is still positive after subtracting the HOA and Clubhouse, indicating that the HOA fees paid far more than compensate for the additional increase in value derived from beach access or security associated with a gated community.

Waterfront location and location on a corner or cul-de-sac appear to enhance sales price, although cul-de-sac location does not appear to significantly influence housing price.

Designation as a national historic district apparently is appealing and hence contribute significantly to a higher sales price. With the exception of Lincolnville, all the other national historic districts coefficients are positive and significant at 1%. Furthermore, compared to other studies (Coffin, 1989; Coombs et al, 2011; Cebula, 2009A) the size of these coefficients is much bigger than for example the 0.2049, or 0.17 in Cebula (2009A), for the three older districts and comparable to the three historic districts that have recently been designated (i.e., 2009-2011). This could be related to the fact that our observations of historic districts are less (182 vs over 500), but our overall number observations is higher (4,017 vs. about 2,800). In addition, the periods of times under study are very different (pre-recession vs. after recession).

The results for the Tiebout (1956) hypothesis indicate that the natural log of the real sales price of house j is found to be (as hypothesized) a decreasing function of the rate of property tax liability associated with the house. Furthermore the size of the coefficient is much larger than in other related studies, which could have important implications in terms of legal tax avoidance (Cebula, 1997).

In terms of the other variables estimated, our results indicate that bank owned, short sales and properties paid cash appear to have a negative effect on the real sales price, while the fact that the owner occupied the home prior to the sale appears to positively influence the housing price. The number of days on market and number of photos on MLS appear to positively have affected the real sale price of a house.

As for the specific contributions of the statistically significant variables on LnRSP, the effects are summarized in Table 3. In a semi-log functional form with the dependent variable being expressed in natural log terms, a one unit change in a non-binary independent variable has a percentage effect on the dependent variable that is given by 100% multiplied by the estimated coefficient, ceteris paribus. For example, with respect

to the interior features of house j, the presence of an additional bathroom causes the real sales price of house j to increase by 8.54%. This factor generates the largest positive sales price response for the non-binary interior features.

By comparison in specification 3 (in this specification, we can use bedrooms instead of baths. Notice that both have a correlation coefficient above 0.7 with sqft fin), the presence of an additional bedroom yields a positive housing price response of roughly …%.

The effect of the SQFTFIN variable on the real sale price of house j is handled somewhat differently because the scale of measurement is per square foot. In particular, the mean square footage is 1,960. A one standard deviation increase in the square footage (767) implies a 13.8% increase in the real sales price of house j. This translates into a situation in which, on the average, the real housing price rises by roughly $43 (in 2005 dollars) for each additional square foot of finished living space, which lies roughly in the middle range for other recent similar studies (e.g., Coulson and Leichenko 2001; Bin and Polasky 2004; Cebula, 2009B).

Presence of either a fireplace, a wood floor, or a cathedral ceiling contributes slightly more than the actual estimated coefficients times 100. (Again: the interpretations of the binary variable coefficients using the procedure in Halvorsen and Palmquist (1980).

Regarding the response of the lnRSP of house j to exterior features, the number of stories present in house j and the number of garage spaces on the premises of house j.
Based on the average of the results in Specification 2, one additional story for house j yields a roughly 6.97% higher sales price (lower than other studies due to maybe St. Augustine having a higher population in or near retirement age, for whom a 2 or more story house can be seen as a negative attribute - elderly people do not prefer to climb stairs), and one additional garage space yields an approximately 5.9% higher sales price.

Binaries: Contemporary construction style adds a 3.84% higher sales price, while a stucco finish adds 2.23%.

In interpreting the coefficients on the dummy (binary) variables, we follow the procedure in Halvorsen and Palmquist (1980). (Notice that for small coefficients this procedure yields very similar/same numbers as the interpretation for the non-binary variables.

The results for the historic district variables indicate that a house designated as a national register historic district in the City of St. Augustine district secures about a 74% premium over a house not so designated. In Model Land and Co this premium is 48%, in Abbott Tract it is 47%, in North City it is about 39%, in Belmar Terrace 26% and in Fullerwood Park about 23%.

These premiums are much larger than in other studies. This could be due to: 1) the fact that historic district homes are a small percentage of overall homes in our sample, which means that they are rare, thus demanding higher premium associated with their location; and 2) recession lowered prices of other non-historic homes, but the historic ones remained unaffected, thus increasing the premium.

The results for the three groups of spatial control variables: A waterfront house commands more than 18% higher price than a house that is not so situated, whereas location on a corner commands more than 2.7% higher price.

To account for proximity/designation of a house to one of the 12 elementary schools in the City of St. Augustine, each of them signaling a different “education quality” we created 12 binary variables indicating which elementary school a given house is supposed to send their elementary school aged children to. Our results indicate that for eight of these schools the effect on real sales price is negative and statistically significant at 5% (1% for most), for 3 is positive and statistically significant at 1%, and for one is statistically not significant.

Finally, the estimated coefficient on the property tax rate variable is negative, as expected, and statistically significant at the 1% level. This finding provides strong empirical support for the Tiebout (1956) hypothesis that higher property taxation reduces the price of housing, *ceteris paribus*, presumably because the property tax liability is capitalized into the housing price (Oates 1969). The mean property tax level for a single-family home in the City of St Augustine housing market is $2,969 while the standard deviation is $2,474. Raising the property tax by one standard deviation ($2,474) would reduce the real price of the average house by 7.4%, i.e., by $15,464.

5. Conclusions

The purpose of this study was to investigate, using the housing market in the City of St. Augustine, Florida, the oldest historic city in the US, the Tiebout (1956) hypothesis that property taxes are capitalized into real housing prices.

The principal findings of this study include the result that the natural log of the real sales price of a single family house in St Augustine over the 2008– 2013 period was negatively impacted by higher property taxes, implying that (as hypothesized) property taxes are capitalized into real housing prices. In addition, there is strong empirical evidence that some community features are positively capitalized into the real housing prices of single-family homes in St Augustine, as it is the quality of education across elementary schools, for which capitalization occurs on both ends: positive and negative.

This study of the St Augustine housing market provides strong empirical support for the Tiebout (1956) hypothesis, a finding that affirms the free market system's efficiency in assessing the impacts governmental actions and policies. These findings are consistent with the classic related earlier study by Oates (1969).

The finding that a policy by city and county governments of raising property taxes would reduce housing prices is important for at least three reasons. First, this particular policy reduces the net wealth of homeowners. Second, the reduced net wealth induces a reduction in consumer spending, which would exert upward pressure on the unemployment rate. Third, to the extent that property tax increases are implemented, the affected areas will experience a reduced population growth from migration. Indeed, net out-migration could occur (Cebula and Alexander 2006), which would create a new round of revenue problems if not crises for city and county governments.

In addition, we found strong evidence that national register historic district designations in St. Augustine have positively affected real sale price by a much higher magnitude than in other studies. I will add a paragraph about the importance of this finding ….

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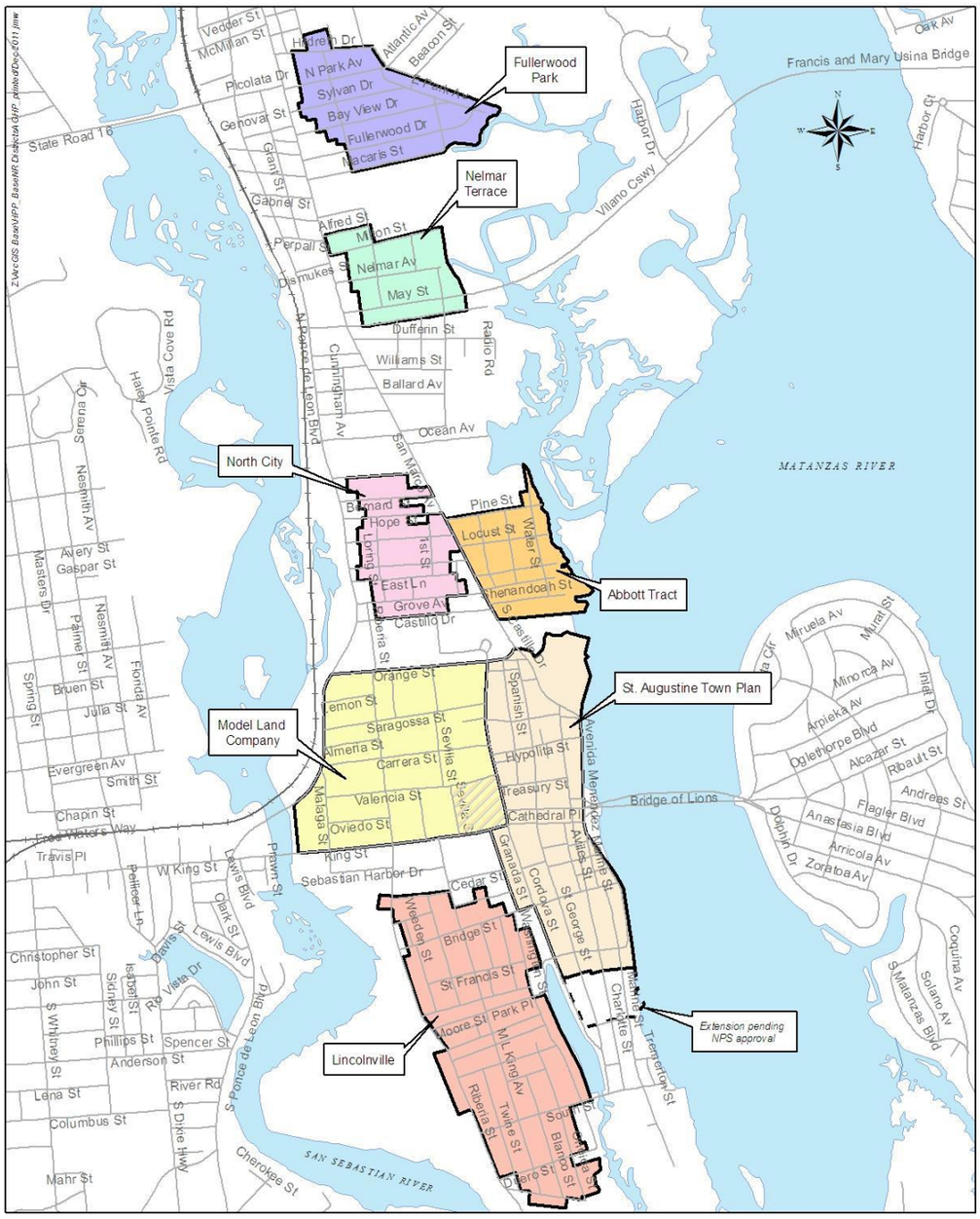
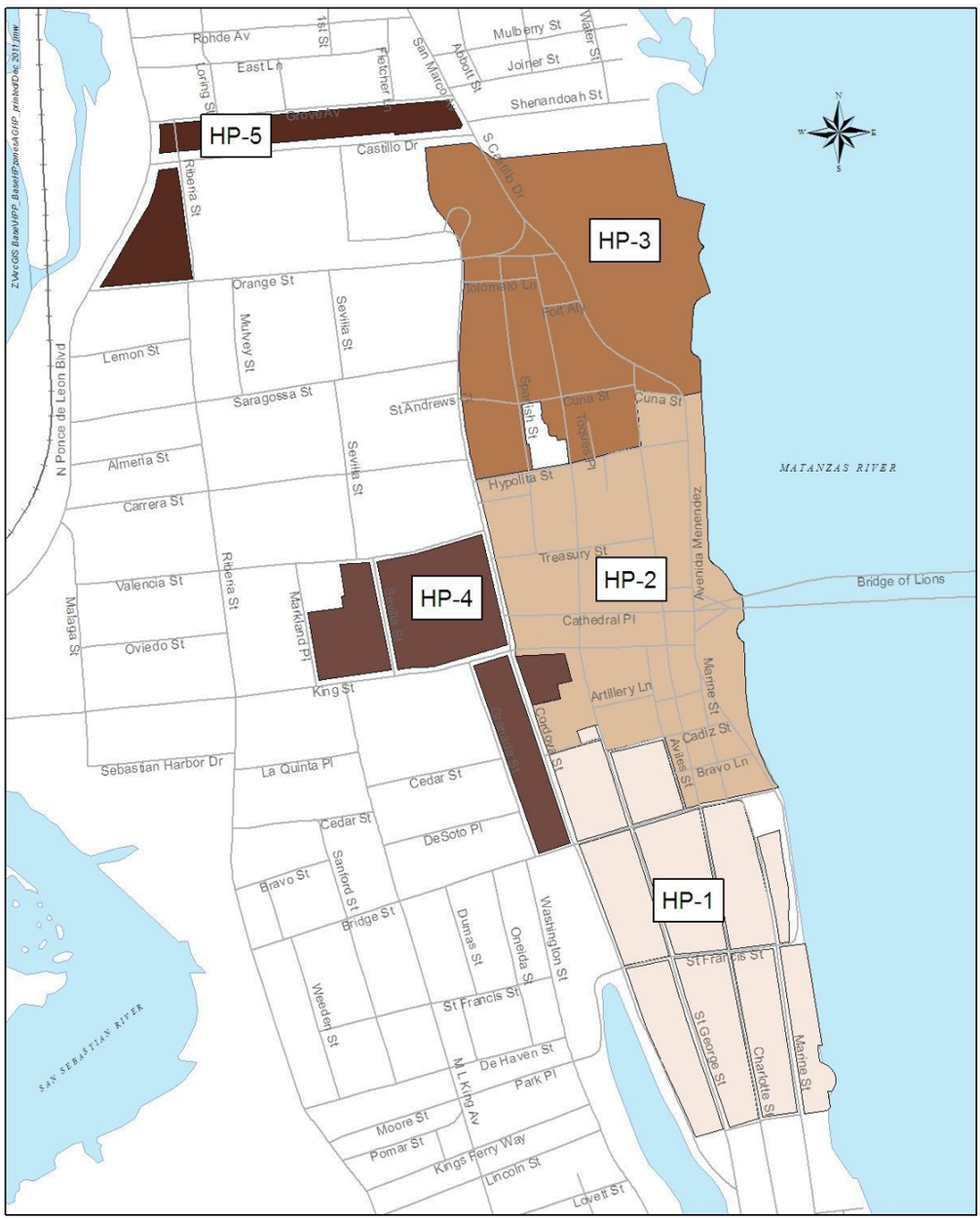
Maps

Map 1: Seven National Register Historic Districts



St. Augustine National Register Historic Districts

Map 2: Local Historic Preservations



St. Augustine Historic Preservation Zones

Graph: Testing for heteroskedasticity