The Housing Price Bubble In A Suburban Georgia Setting: Using The Hedonic Pricing Model In The New South

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ABSTRACT

This study applies a hedonic pricing model to the rapidly developing suburban housing market adjacent to the Savannah Historic Landmark District in the downtown area of Savannah, Georgia. Using OLS estimation, the hedonic pricing model yields results clearly tracing out the magnitude of the time-related housing price premium in the suburban market analyzed for the years from 2005 to 2010. The results also control for internal and external housing characteristics that are capitalized into the real sales prices of the housing transactions analyzed.

Keywords: Housing Price Bubble; Hedonic Pricing Model; Housing Prices

INTRODUCTION

The hedonic pricing model has been applied widely in a variety of circumstances to explore housing price behavior in many studies over the years. Excellent overviews of this literature are provided by the comprehensive survey articles by Boyle and Kiel (2001) and Sirmans, Macpherson and Zeitz (2005). Indeed, the hedonic pricing model has been deployed to study wide-ranging factors affecting housing prices such as natural disasters (Murdoch, Singh and Thayer, 1993; Bin and Polasky, 2004; Harrison, Smersh and Schwartz, 2001; Sutter and Poitras, 2010), environmental quality (Graves, Murdock and Thayer, 1988; Garrod and Willis, 1992; Smith and Huang, 1993; Levesque, 1994; Dotzour, 1997; Decker, Nielsen and Sindt, 2005; Netusil, 2005; Neill, Hassenzahl and Assane, 2007; Ramirez, Schaerer, and Philippe, 2008; Steimetz, 2010), safety (Couton, Gardes and Thepauti, 1996), education (McMillen, Seaman and Singell, 2007), and the effects of historic district designation (Coffin, 1989; Ford, 1989; Asabere and Huffman, 1994; Asabere, Huffman and Mehdian, 1994; Clark and Herrin, 1997; Coulson and Leichenko, 2001; Leichenko, Coulson and Listokin, 2001; Cebula, Goldman and Toma, 2008). The recent boom and bust cycle in the nationwide housing market has received treatment by Shimizu and Nishimura (2007), Dorsey, et al. (2010) and Shimizu and Watanabe (2010).

The present study seeks to extend the literature on the housing asset price bubble through application of the hedonic pricing model to house prices in a suburban setting outside of the Historic Landmark District in Savannah, GA. Housing prices in Savannah's historic district have been investigated in nominal terms by U.S. Advisory Panel (1979) and in real terms by Cebula, Goldman and Toma (2008). In many respects, this study is complementary to that of Cebula, Goldman and Toma (2008) by considering residential real estate development in a suburban setting that is more likely to have been affected by the housing bubble than the downtown housing market in the historic district. The geography of Savannah and the path of development in the area support this hypothesis. The downtown historic district is bounded on the north by the Savannah River and the marshlands of South Carolina; bordered to the east by well-developed land scattered across barrier islands leading to the Atlantic Ocean; and bordered to the direct south by suburban development that dates from the 1960s to 1980s. Recent new residential construction in these areas is primarily small in scale and of the in-fill variety.

However, to the southwest and west of Savannah in Chatham County along the Interstate 95 corridor, new housing permits have been authorized for up to 40,000 mostly middle class housing units (Savannah Morning News, 2005) for expected development during the next twenty years. This area has experienced substantial development of new, large-scale neighborhoods leading up the housing market crash in 2007. The new developments, and by proximity, existing development in the western suburbs of Savannah are more likely to have been affected by the over-development of residential housing construction that swept the nation. Indeed, the cross-tabulation of average and median home sales prices, mean days on market, and number of transactions by year in Table 1 bears this out. In 2006, 970 homes sold in this portion of the county at a median sale price of $186,663, while by December 2010, sales volume decreased to less than 500 homes at a median sale price of $158,995. The mean number of days on market before a sale was just under three months in 2006 and over five months by 2010. It is clear from these descriptive statistics that the study area southwest and west of Savannah was affected substantially by the housing market boom and bust cycle.

Table 1. Cross Year Comparisons

Year	Sold Homes	Mean Sales Price	Median Sales Price	Days on Market
2006	970	198,855	186,663	84.59
2007	794	192,901	182,210	108.34
2008	694	177,432	171,174	141.44
2009	723	174,047	167,322	151.19
2010*	498	168,616	158,995	162.34

*Data through November 2010. Data expressed in 2010 constant dollars, where applicable.

While much of the hedonic housing price literature focuses on the overall market, more recent studies have considered sub-components of the market by price (Bourassa, Hoesli, and Peng, 2003; Ho, Ma, and Haurin, 2008; Farmer and Lipscomb, 2010). These authors observe significant sub-market differentials in housing price sensitivity to housing attributes. The present study notes these results and therefore focuses on middle class housing to evaluate whether a time varying housing price premium is present in the market studied.

The transaction price of the homes studied was between $75,000 and $300,000 in nominal terms. As suggested above, the wave of recent development in the Savannah area has been to the west and southwest of the downtown and islands areas that are characterized by a greater density of premium residential housing. For example, the mean real transaction price for a single family home in the downtown historic landmark district in 2010 was $359,146 while on Tybee Island, a coastal resort barrier island, the mean 2010 sale price was $319,335. By comparison, only 59 of 658 (9%) house sales west of Savannah had a transaction price that exceeded $320,000 in 2010. The density of typical middle class housing in our data set facilitates the focus of the present study on the housing bubble's effects on recently developed and developing middle class residential housing prices.

The unique aspect of the present study is that the magnitude of the time-varying housing price premium is identified in a suburban market characterized by very recent development leading up to the nationwide bust in real estate. Similar to Cebula, Goldman and Toma (2008), this analysis includes variables that characterize the seasonal variation of real sale prices of homes in a suburban setting. This allows the estimation of a recurring pattern in quarterly data in the presence of an underlying trend driving home sale prices. However, one additional interesting facet of this analysis is that the period of study (2005 to 2010) immediately follows that considered by Cebula, Goldman and Toma (2008) in their investigation of historic landmark housing prices from 2000 through 2005. Thus, their research may include some effects of the housing price bubble in historic district properties, but they do not expressly control for the annual fixed effects attributable to a broadly evolving time trend.

The next section provides a description of the data set analyzed and the hedonic pricing model. As is common in the literature, the model is estimated in linear and semi-log form. The subsequent section provides the results of several specifications of the model and an interpretation of the results. The last section is a conclusion summarizing the results.

THE FRAMEWORK FOR THE EMPIRICAL ANALYSIS

Sirmans, Macpherson and Zeitz (2005) provide a thorough overview of the underlying theory and summary of numerous empirical applications of the hedonic pricing model, and thus, the theoretical foundation receives little more than summary treatment herein. The straightforward premise is that a house characterizes a package or bundle of desirable and undesirable factors for utility-maximizing consumers to evaluate. The valuation of these features is capitalized into the transaction price of the house. The hedonic pricing model parses the transaction price into attributes such as interior and exterior features, locational factors, idiosyncratic characteristics associated with the house, and seasonal and annual fixed-effects. The model's estimated parameters provide information about the significance and magnitude of the effect of any given, observable, attribute of the house.

The hedonic pricing model applied in the present study takes the following form:

PRICEj = f(Ij, Ej, Oj)

and

LnPRICE j = f(Ij, Ej, Oj)

where:

PRICEj = the *real* price of house j, where the price of the jth house is expressed in 2010 dollars;

and

LnPRICEj = the natural log of the *real* price of house j, where the price of the jth house is expressed in 2010 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.

This model is estimated using a five-year period of data from November 2005 to November 2010 to assess the relative importance of housing characteristics and time-related effects on real home sales prices in a suburban setting characterized by recent residential development. Data were obtained from the Savannah Board of Realtors' Multiple Listing Service. Since middle class housing was the focus of this study, observations were limited to homes that sold for between $75,000 and $300,000, which resulted in 3,852 sold homes. As this area of Chatham County has been the source of virtually all of the area's growth, a sizable portion, 63%, of the sold homes were new construction. Nominal housing prices were converted into real values using the quarterly CPI obtained through the BLS website (www.BLS.gov). The average house in the sample was a single family dwelling (i.e. not a townhouse/condominium) located in the 31419 zip code, was 1,751 square feet, had two bathrooms, a fireplace, a two car garage, a laundry room, was associated with a covenant, and sold for $184,553 in the third quarter of 2006.

There were a variety of interior and exterior physical characteristics available for each house sold, as well as other factors that were included in the analysis. These factors are listed and formally defined in Table 2. The key descriptive statistics for each of the variables considered in the analysis are provided in Table 3. Naturally, for each of the impacts of the explanatory variables on housing price in the model, the expected sign is proffered under the assumption of *ceteris paribus*.

Table 2. Variables in the Model

PRICE= the price of house j expressed in 2010 dollars
LnPRICE= the natural log of the price of house j expressed in 2010 dollars
SQFT= the total number of square feet of finished living space in house j
BATHS= the total number of full bathrooms in house j
GARAGE= the number of garages spaces on house j's premises
AGE= the age of house j
LAUNDRY= a binary variable = 1 when house had a laundry room and =0 otherwise
HARDWOOD= a binary variable = 1 when house had hardwood floors and =0 otherwise
CEILING9 = a binary variable = 1 when house had 9 foot (or higher) ceilings and =0 otherwise
COV= a binary variable= 1 when house was associated with a covenant and =0 otherwise
ELEC= a binary variable = 1 when house was all electric and =0 otherwise
FIREPLACE= the number of fireplaces in house j
FORCLOSE= a binary variable = 1 when house was a foreclosure and =0 otherwise
WATERFRNT= a binary variable = 1 when house was waterfront and =0 otherwise
NEW= a binary variable =1 when house was new at the time of sale and = 0 otherwise
SPRINKLER=a binary variable=1 when house had underground sprinkler system= 0 otherwise
TOWNHOUSE= a binary variable=1 when house was a townhouse or condo and = 0 otherwise
Q1= a binary variable=1 when house was sold in first quarter (Jan-March)
Q2= a binary variable=1 when house was sold in second quarter (April-June)
Q3= a binary variable=1 when house was sold in third quarter (July-Sept)
Q4= a binary variable=1 when house was sold in fourth quarter (Oct-Dec)
Y2005= a binary variable =1 when house was sold in year 2005
Y2006= a binary variable =1 when house was sold in year 2006
Y2007= a binary variable =1 when house was sold in year 2007
Y2008= a binary variable =1 when house was sold in year 2008
Y2009= a binary variable =1 when house was sold in year 2009
Y2010= a binary variable =1 when house was sold in year 2010
Z31302= a binary variable =1 when house was sold in zip code 31302
Z31322= a binary variable =1 when house was sold in zip code 31322
Z31405= a binary variable =1 when house was sold in zip code 31405
Z31407= a binary variable =1 when house was sold in zip code 31407
Z31406= a binary variable =1 when house was sold in zip code 31406
Z31419= a binary variable =1 when house was sold in zip code 31419

The interior physical characteristics of house j include: SQFT, the number of square feet of finished interior living space; BATHS, the total number of full baths; AGE, the age of the house in years; LAUNDRY, the presence of a laundry room; HARDWOOD, the presence of hardwood floors; CEILING9, the presents of nine foot (or higher) ceilings, ELEC, indicating that the house was all electric; and FIREPLACES, the total number of fireplaces. The number of bedrooms was omitted because it was very highly correlated with the variables SQFT and BATHS. Additionally, there was very little variation in the number of bedrooms in the sample. The mean number of bedrooms was approximately 3.22, with a standard deviation of 0.63.

As observed in Sirmans, Macpherson and Zeitz (2005), and based on a variety of other studies, including Ford (1989), Clark and Herrin (1997), Coulson and Leichenko (2001), Leichenko, Coulson and Listokin (2001), Laurice and Bhattacharya (2005), and Decker, Nielsen and Sindt (2005), the real sales price (PRICE and LnPRICE) of house j is expected to be an increasing function of the number of desirable internal physical housing characteristics. For example, LnPRICE is expected to be an increasing function of the number of bathrooms, fireplaces, and square footage of finished living space. It also is expected to be an increasing function of the presence of a laundry room, hardwood floors, and nine foot ceilings. In addition, since older homes may have a higher likelihood of needing repair and may more imperfectly reflect modern preferences, LnPRICE is expected to be a decreasing function of the age of the house.

The exterior physical characteristics of house j include: GARAGE, the number of garage car spaces that are part of the house; WATERFRNT, whether the house is on a water front lot; SPRINKLER, whether the house has an underground sprinkler system; and TOWNHOUSE, whether the house was a townhouse versus a single family dwelling.

Since water front property is usually desirable, LnPRICE of house j is expected to be an increasing function of WATERFRNT. As observed by Laurice and Bhattacharya (2005), the number of garage spaces (Leichenko, Coulson and Listokin, 2001; Laurice and Bhattacharya, 2005) is likewise expected to be positively related to the selling price. The presence of an underground sprinkler system is predicted to increase the sales price (Sirmans, Macpherson and Zeitz, 2005). As a private back yard may be desirable, TOWNHOUSE is expected to be negatively related to sales price.

Table 3. Descriptive Statistics

Variable	Mean	Standard Deviation
PRICE	184553.7	48070.14
LnPRICE	12.09	0.26
SQFT	1751.1	494.18
BATHS	2.09	0.35
GARAGE	1.64	0.67
AGE	8.21	10.19
LAUNDRY	0.68	0.47
HARDWOOD	0.29	0.46
CEILING9	0.32	0.47
COV	0.88	0.32
ELEC	0.93	0.25
FIREPLACE	0.58	0.50
FORCLOSE	0.003	0.05
WATERFRNT	0.08	0.27
NEW	0.64	0.48
SPRINKLER	0.23	0.42
TOWNHOUSE	0.17	0.37
Q1	0.21	0.41
Q2	0.27	0.44
Q3	0.28	0.45
Q4	0.25	0.43
Y2005	0.05	0.21
Y2006	0.25	0.43
Y2007	0.21	0.41
Y2008	0.18	0.38
Y2009	0.19	0.39
Y2010	0.13	0.34
Z31302	0.004	0.39
Z31322	0.36	0.48
Z31405	0.08	0.28
Z31407	0.12	0.32
Z31408	0.007	0.08
Z31406	0.042	0.20
Z31419	0.38	0.49

N=3,852

Several other idiosyncratic factors associated with house j include: NEW, whether the house was new at the time of sale, and COV, whether the house was associated with a home owners association covenant. As suggested in Sirmans, Macpherson and Zeitz (2005), Clark and Herrin (1997), Decker, Nielsen and Sindt (2005), Ford (1989), and Laurice and Bhattacharya (2005), the age of a house is expected to adversely influence its sales price. Accordingly, it is argued here that a "new" house will tend to command a greater market price. The variable FORCLOSE indicates the house to have been a foreclosed property and is likely to be associated with a lower selling price.

Seasonal controls by quarter, Q1 (January through March), Q2 (April through June), Q3 (July through September), and Q4 (October through December) are included to control for any seasonal effects, but no expectations about sign are overly obvious. Likewise, locational controls are present in the form of zip code fixed

effects (Z31302, Z31322, Z31405, Z31407, Z31408, Z31406, Z31419), but, again, no *a priori* expectations are immediately clear.

Most importantly for this study, yearly fixed effects, Y2005 through Y2009 (with year 2010 as the omitted category) are included. The coefficients on these variables will be used to evaluate whether an asset price bubble was present, and if so, to measure the magnitude of the housing bubble in suburban Chatham County.

EMPIRICAL RESULTS

This section presents the results of the estimated hedonic model described in the previous section. Two similar specifications were used, differing only in their respective dependent variables. In the first, PRICE was used and in the second, a semi-log specification was employed and thus the dependent variable was LnPRICE. In each of the estimates, the White (1980) procedure is adopted to correct for heteroskedasticity. Estimates are provided in Table 4.

All of the estimated coefficients exhibit the expected signs (where an expectation was present) with most reaching high levels of statistical significance. In the semi-log specification, twenty-two of the twenty-nine independent variables were statistically significant at the 1% level, with two additional variables reaching statistical significance at the 10% level of significance. Excluding the locational zip code controls, only two variables fail to reach statistically significance at any conventional level. The coefficient of determination indicates that for each specification, nearly 80% of the variation in the dependent variables (PRICE and LnPRICE) was explained by the model. Finally, the F-statistic is significant at far beyond the one percent level in both cases, yielding evidence regarding the overall strength of the models.

Based on estimates in Table 4, the *real* sales price of houses in suburban Savannah is a positive function of size (SQFT), number of bathrooms, garage spaces, and fireplaces. In addition, the presence of a laundry room, nine foot ceilings, hardwood floors, an underground sprinkler system, being associated with a covenant, and being water front add to the sales price. Undesirable house features that reduce the natural log of the real sales price are the house being all electric, being a townhouse, being a foreclosed property, and being an older home.

Note that while the signs were as expected on these interior characteristics, a few of the coefficients were larger in magnitude that what might be expected. For example, the semi-log model predicts that a house having hardwood floors would be associated with nearly an eight percent premium. Evaluated at the mean, this implies a nearly $13,000 increase in value. The other specification of the model, with PRICE as the dependent variable, suggests the premium is even larger: $16,563. One explanation of this high premium could be that this characteristic is correlated with other desirable amenities that are not included in the model. For example, homes with hardwood floors may be more likely to have other upgrades, such as granite countertops or more expensive fixtures, and if these characteristics are omitted from the model, the correlated variable will be biased upward.

Additionally, some seasonality can be observed. Homes sold in the first or second quarter of a given year sell for a 2.9% and 2.4% premium respectively over those sold in the fourth quarter. Those sold in the third quarter sold, on average, for slightly more (one half of one percent) than those in the fourth quarter, but the difference was statistically indistinguishable from zero.

The rise and fall of the housing boom can be readily seen in these results. Peaking in 2006, where home prices saw a 23% premium relative to their eventual level in 2010, home values experienced a steady decline, falling slowly at first by a little over two percentage points in 2007, then declining nine percentage points in 2008, followed by yet another 5 percentage point decrease in 2009. All of these yearly fixed effects were highly statistically significant across both specifications.

Based on the above findings, a closer look was taken at the trend with an alternative model specification. All of the structural and locational controls remained as before but in place of the seasonal and yearly controls (Q1-Q3 and Y2005-Y2009), quarterly fixed effects were included (Q1_2005 through Q2_2010). The third quarter of 2010 was used as the reference group as it was the final quarter for which complete data were available. Table 5

presents the results of this specification for the quarterly fixed effects (other results are present but suppressed) which more clearly highlights the ups and downs of suburban housing prices in this period. The buildup can be seen in late 2005 to the peak in 2006, after which, a relatively steady decline is apparent.

Table 4. OLS Estimates of the Hedonic Pricing Model

Variable	Dep Var: PRICE		Dep Var: LnPRICE	
	Coefficient	T-Statistic	Coefficient	T-Statistic
Constant	18,592.76		11.219	
SQFT	53.30***	(46.37)	0.0003***	(48.22)
BATHS	6,416.15***	(4.73)	0.033***	(5.00)
GARAGE	9,194.51***	(9.69)	0.065***	(12.62)
AGE	-511.87***	(-6.85)	-0.004***	(-7.68)
LAUNDRY	5,330.90***	(6.36)	0.029***	(6.38)
HARDWOOD	16,563.47***	(16.09)	0.075***	(14.8)
CEILING9	8,738.80***	(8.96)	0.045***	(9.26)
COV	8,703.15***	(5.71)	0.054***	(6.52)
ELEC	-4,836.19**	(-2.26)	-0.035***	(-2.95)
FIREPLACE	11,174.14***	(12.71)	0.060***	(12.86)
FORCLOSE	-15,805.51**	(-2.11)	-0.093*	(-1.92)
WATERFRNT	3,238.30**	(2.16)	0.019***	(2.52)
NEW	655.54	(0.56)	0.005	(0.75)
SPRINKLER	10,053.37***	(9.44)	0.051***	(9.68)
TOWNHOUSE	-7,101.92***	(-4.06)	-0.049***	(-5.20)
Q1	5,224.16***	(4.53)	0.029***	(4.86)
Q2	4,753.87***	(4.45)	0.024***	(4.38)
Q3	1,081.63	(1.01)	0.005	(0.85)
Y2005	37,217.65***	(17.04)	0.211***	(18.39)
Y2006	41,593.93***	(29.37)	0.230***	(30.38)
Y2007	37,105.19***	(26.38)	0.207***	(26.83)
Y2008	19,397.26***	(14.71)	0.117***	(15.48)
Y2009	10,510.86***	(7.64)	0.061***	(8.02)
Z31302	1,977.78	(0.27)	0.006	(0.17)
Z31322	-2,262.02**	(-2.45)	-0.021***	(-4.44)
Z31405	5,513.78***	(2.72)	0.008	(0.81)
Z31407	-16,566.08***	(-11.43)	-0.119***	(-15.75)
Z31408	1,367.86	(0.28)	0.016	(0.59)
Z31406	2,671.73	(1.29)	0.021*	(1.83)
Adjusted R^2	0.775		0.791	
F	452.15		510.24	

*** significant at the 1% level, ** significant at the 5% level, *significant at the 10% level
The omitted binary variables are Q4, Y2010, and Z31419.

Table 5. OLS Estimates of the Quarterly Fixed Effects of the Hedonic Pricing Model

Dep Var: LnPRICE					
Variable	**Coefficient**	**T-Statistic**	**Variable**	**Coefficient**	**T-Statistic**
Q4_2005	0.216***	(16.26)	Q1_2008	0.155***	(11.53)
Q1_2006	0.243***	(19.01)	Q2_2008	0.142***	(11.30)
Q2_2006	0.251***	(20.22)	Q3_2008	0.125***	(9.72)
Q3_2006	0.246***	(19.83)	Q4_2008	0.125***	(9.43)
Q4_2006	0.260***	(20.32)	Q1_2009	0.108***	(8.01)
Q1_2007	0.249***	(18.20)	Q2_2009	0.098***	(7.74)
Q2_2007	0.243***	(18.20)	Q3_2009	0.067***	(4.71)
Q3_2007	0.224***	(17.77)	Q4_2009	0.058***	(4.24)
Q4_2007	0.187***	(13.55)	Q1_2010	0.043***	(2.69)
			Q2_2010	0.034**	(2.39)
Adjusted R^2 = 0.793, F = 375.13					

*** significant at the 1% level, ** significant at the 5% level, significant at the 10% level
Note: The omitted variable is Q3_2010. All non-time related controls are present but suppressed.

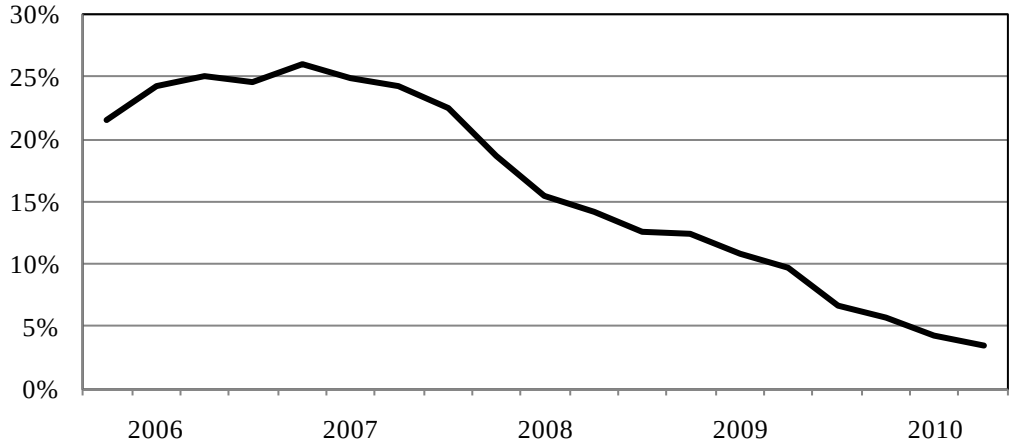
CONCLUSION

This study applies the hedonic pricing model to middle class houses sold in a suburban area of Savannah characterized by substantial development since 2000. The study focuses on middle class houses sold within this area for the five-year period from November 2005 through November 2010. House prices are expressed in 2010 dollars. The basic model structure is that 15 internal and external housing attributes could potentially affect *real* housing prices. Furthermore, the models include seven general geographic controls based on zip codes, and quarterly variables characterizing the three-month period of the year in which the transaction took place to identify and control for the peak selling season in this portion of Chatham County.

The findings of this study are that the level and natural log of real sales price of a middle class house in suburban Savannah during the 2005-2010 period was positive function of size (SQFT), number of bathrooms, garage spaces, and fireplaces. In addition, the presence of a laundry room, nine foot ceilings, hardwood floors, an underground sprinkler system, being associated with a covenant, and being water front add to the sales price. Undesirable house features that reduce the natural log of the real sales price include being all electric, a townhouse, foreclosure, and age of the house. Sale of the house during the first two quarters of the year raises the real sales price.

As indicated above, the primary focus of this study was an investigation of the time-varying housing price premium over the boom and bust housing market cycle. These fixed-effects are estimated in annual and quarterly terms. Based on annual data, the housing market in the study area peaked in 2006 with prices at a 23% premium as compared to 2010. The quarterly data allows the identification of the peak in the fourth quarter of 2006, when the time-dependent housing price premium reached 26% as compared to the third quarter of 2010. Figure 1 below plots the estimated quarterly fixed effects and clearly identifies the peak of the housing market and the subsequent deflation of the housing asset bubble in the middle class suburbia of Savannah, GA.

Figure 1. Estimated Quarterly Fixed Effect on Housing Prices



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