MEASURING SECONDARY EFFECTS OF ADULT BUSINESSES USING SPATIO-TEMPORAL ESTIMATION OF REAL ESTATE PRICE APPRECIATION

George W. McCarthy
University of North Carolina at Chapel Hill

Henry Renski
University of North Carolina at Chapel Hill

Daniel Linz
University of California at Santa Barbara

5/24/01

Please address all correspondence to:
George McCarthy
21 Cramer Rd.
Rhinebeck, NY 12572
(914) 876-2460
mac@webjogger.net

THIS IS A DRAFT—DO NOT CITE WITHOUT AUTHORS' PERMISSION

INTRODUCTION

In recent years, there has been increased interest in measuring secondary effects of some activities in surrogate markets. For example, locating less desirable activities in one place can have measurable effects in related markets. Locating nuclear power plants exposes neighbors to increased risk of exposure to radioactivity due to an accident at the plant. Attempts to block the location of landfills, prisons, waste incinerators or a raft of other activities generate organized efforts commonly labeled not-in-my-back-yard (NIMBY). The efforts typically involve popular protest, extensive lobbying of public officials, and legal efforts to protect local populations from the unwanted negative effects.

Legal avenues have been used successfully in recent years to influence the location and the character of the operation of so-called adult entertainment establishments. Opponents of sex clubs have used claims of negative secondary effects to justify closing or changing the way business is done in the clubs. Cities and municipalities who have wished to prohibit adult businesses from operating in certain areas have justified these "zoning" regulations by appealing to the idea that the presence of the business will have so called "adverse, or negative secondary effects" on the surrounding community. One effect most frequently identified is the decrease in the value of properties located near these establishments. Some claim that property value losses are related to an increase in criminal activity associated with the adult clubs.

While some efforts to close, or change the nature of business conducted in, adult clubs have been successful, there is little formal evidence of negative effects on real estate values associated with proximity to adult establishments. In this paper, we use a dynamic model of house price appreciation in a large urban market to measure secondary effects. By identifying parcels in close proximity to adult entertainment establishments, we use the model to estimate the influence of these clubs on the price appreciation of nearby real estate.

Researchers have examined the dynamics of house price appreciation extensively (see for example Goodman 1988; Case and Schiller 1989; and Case and Quigley 1991, Crone and Voith 1992, and Clapp and Giaccotto 1999)[1]. Researchers have examined both the temporal (appreciation over time) and spatial (locational effects) dimensions of price appreciation. There is also an emerging literature on combining both temporal and spatial measurement issues (Quercia, McCarthy Ryznar and Can, 2000; Crone and Voith, 1999).

We begin the paper with a review the legal issues surrounding negative secondary effects associated with sex clubs. This is followed with a review of studies that attempt

---

[1]See special issues of the *Journal of Real Estate Finance and Economics* (14(2) January March 1997) and *Journal of the American Real Estate and Urban Economics Association* (19(3) Fall 1991).

to assess these negative secondary effects.   Other research studies on temporal, neighborhood and spatial effects on house price changes that are not related specifically to the sex club issue are then reviewed.

Following the literature reviews, we present an empirical study that advances a state of the art estimation method to assess secondary effects. In this study we adopt an expanded repeat housing sales model to estimate, over time and space, appreciation rates for real estate parcels. Using 1980-2000 tax assessment data from Mecklenburg County, North Carolina, we estimate annual appreciation rates and evaluate the extent to which appreciation rates are related to the location of adult clubs.

We show that there is little evidence of a negative impact of the location of adult clubs on house price appreciation. While house prices show a slightly lower average appreciation rate over the entire period, when spatial and temporal controls are added, appreciation rates are actually higher for parcels in close proximity to adult clubs in 11 of the 20 years of the study. We end the paper with a discussion of the results and their implications for further research and policy.

LITERATURE REVIEWS

THE LEGAL BACKDROP

Since 1976, the United States Supreme Court has decided a series of cases focusing on whether the free speech clause of the First Amendment allows cities and states to enact legislation controlling the location of adult businesses. These zoning regulations (e.g., laws or ordinances that prevent a sex-related business from operating within a certain number of feet from residences, schools and houses of worship or a given distance from one another) have been predicated on the notion that cities and other municipalities have a substantial interest in combating so-called negative secondary effects on the neighborhoods surrounding adult businesses.

These secondary effects have most often included alleged increases in crime, decreases in property values, and other indicators of neighborhood deterioration in the area surrounding the adult business. Typically, communities have either conducted their own investigations of potential secondary effects or have relied on studies conducted by other cities or localities.

In more recent years, the Court has considered the constitutionality of anti-nudity ordinances passed by municipalities or states that have relied on negative secondary effects to justify the legislation. The Court in *Barnes v. Glens Theater Inc.*, held that the State of Indiana could regulate nudity. Justice Souter and a plurality of the Court ruled that the government could undertake such regulation on the basis of the presumed negative secondary effects on the surrounding community. More recently, in *City of Erie v. Pap's A.M.* the Court again held that municipalities have the right to pass anti-nudity ordinances. Again, however, the Court was divided. Three Justices agreed with Justice

O'Connor's opinion that combating negative secondary effects associated with adult businesses was a legitimate basis for the imposition of an anti-nudity ordinance.

Justice Souter's dissent in the *Pap's* decision is noteworthy. He significantly revised the position he took regarding secondary effects in *Barnes*. In *Pap's*, Justice Souter admitted that the evidence of a relationship between adult businesses and negative secondary effects is at best inconclusive. He called into question the reliability of past studies that purported to demonstrate these effects and suggested that municipalities wishing to ban nudity must show evidence of a relationship between adult businesses and negative effects.

In the last 25 years, beginning with the 1976 case, *Young v. American Mini Theatres Inc.,21* several United States Supreme Court decisions have provided guidance as to what constitutes permissible government regulation of the location of adult entertainment establishments under the free speech clause of the First Amendment. The Court has normally subjected ordinances which restrict the location of adult businesses to an evaluation under the framework for content-nuetral restrictions on symbolic speech set forth in the four-part test in *United States v. O'Brien.*

Justice Powell applied the four-part *O'Brien* test in his concurring opinion in *Young*. In this case, the Court upheld a Detroit zoning ordinance that regulated the location of adult theaters. The ordinance mandated that adult theaters not locate within 1,000 feet of any two other ìregulated usesî or within 500 feet of a residential area. The Detroit ordinance did not attempt to eliminate adult entertainment; rather its aim was to disperse such businesses in an effort to minimize so called negative secondary effects. In upholding this ordinance, the plurality opinion of the Court reaffirmed the doctrine that a statute (including a zoning ordinance) must have a real and substantial deterrent effect on legitimate expression before it will be invalidated. The Court said the ordinance was not an invalid prior restraint on protected expression because it had neither the intent nor the effect of suppressing speech, but was aimed at controlling the secondary effects caused by adult businesses on surrounding uses.

In another landmark decision regarding a municipality's attempt to control secondary effects allegedly caused by adult businesses, *City of Renton v. Playtime Theatres*, the Court upheld a Renton, Washington, zoning ordinance that, although not banning adult businesses altogether, did prohibit them from locating within 1,000 feet of any residential zone, church, park, or school. The Court held that the Renton ordinance did not restrict First Amendment rights, as the purposes of the ordinance were unrelated to the suppression of speech, and the restrictions were the least intrusive means by which to further the government's interests. Part of the constitutional precedent set forth by the decision in *Renton* is a three prong test stipulating that an ordinance must : 1) be content neutral and only aimed at curbing secondary effects, 2) provide alternate avenues of communication, and 3) further a substantial governmental interest.

It is noteworthy that in this case the Court stated, for the first time, that a city interested in

restricting the operation of adult businesses was not required to show adverse impact from the operation of adult theaters, but could instead rely on the experiences of other cities as a rationale for supporting the passage of an ordinance.28 Prior to this ruling, the lower Court of Appeals found that "because the Renton ordinance was enacted without the benefit of studies specifically relating to the particular problems or needs of Renton, the city's justifications for the ordinance were conclusory and speculative".

The Supreme Court maintained that the Court of Appeals had required an unnecessary burden of proof on the city. The Court ruled that Renton could rely primarily on experiences of, and studies produced by the nearby city of Seattle as evidence of a relationship between adult uses and negative secondary effects. Thus, the Court ruled that the First Amendment does not require a city to conduct new studies or produce new evidence before enacting an ordinance, so long as the evidence relied upon is reasonably believed to be relevant to the problem the city faces.

The Court's opinion in *Renton* established that cities themselves are not required to show adverse impact, but could rely on other cities' experiences to establish that a sufficient government interest was at stake. Since *Renton,* a number of cities, counties, and states have undertaken investigations intended to establish the presence of such secondary effects and their connection to adult facilities. These studies have, in turn, been shared with other municipalities and generally served as the basis for claims that adult entertainment establishments are causally related to harmful secondary side effects, such as increased crime and decreases in property values. Many local governments across the United States have relied on this body of shared information as evidence of the secondary effects of adult businesses. Further, in most cases, cities and other governmental agencies have used the experiences of a core set of studies from other locales as a rationale for instituting regulation of such businesses in their own communities.

This recent expansion of the negative secondary effects "doctrine" to include not only the zoning of adult businesses but now the regulation of the content of expression within these establishments, begs the question: How reliable and valid are "studies" conducted by individual municipalities and shared nationwide with other municipalities attempting to regulate the location of, and most recently, erotic expression within, adult businesses?

The basic requirements for the acceptance of scientific evidence such as the secondary effects studies were prescribed by the Supreme Court in the 1993 case of *Daubert v. Merrell Dow*.51 In *Daubert,* Justice Blackmun held that there are limits on the admissibility of scientific evidence offered by "expert witnesses" in federal courts. The Court noted that scientific knowledge must be grounded in the methods and procedures of science and must be based on more than subjective belief or unsupported speculation. Offering observations as to how this connection can be made, the Court provided a list of factors that federal judges could consider in ruling on a proffer of expert scientific testimony, including: the notion of falsifiability, peer review and publication, error rate, and adherence to professional standards in using the technique in question.

It is important to keep these standards in mind when considering the body the research that has been brought to bear to support. This research is discussed in the following section. For a full, critical evaluation of the literature, see: Bryant, Paul, Daniel Linz, and Bradley Shaferá (2000).

SOCIAL SCIENTIFIC ATTEMPTS TO ASSESS NEGATIVE SECONDARY EFFECTS

The body of social science research sponsored by the 1970 Presidential Commission on Obscenity and Pornography in the United States was the first systematic academic foray into the study of the affects of exposure to sexually explicit materials. Consistent with the more liberal Court rulings in the 1960's, the commission concluded that there were no scientifically demonstrated harmful effects of pornography and recommended legalization of all forms of sexually explicit communication.

During the 1980s social science research testing feminist socio-legal theory examined pornography's effect on attitudes that justify violence towards women, undermine viewer sensitivity to female victims of rape and violence, and increase discriminatory behavior. The research has generally shown that exposure to violent pornography and other media depictions of violence against women increases viewer acceptance of violence toward women in other contexts and decreases sensitivity toward female victims of sexual violence.

Four studies have been most frequently cited (and relied upon) to establish the extent of negative secondary effects. These studies, designated by city are: Indianapolis, IN (1984),Phoenix, AZ (1979), Los Angeles, CA (1977), and St. Paul, MN (1978). These studies have been cited as evidence of the relationship between adult entertainment businesses and negative secondary effects by no less than 27 different municipalities (Bryant, et al, 2000).

Among the studies, the St. Paul, Minnesota (1978) work represents the most methodologically sound of all of the empirical research we reviewed. Ironically, given its widespread use as justification for passing regulations designed to combat secondary effects, the study does not claim to have found any support for the existence of a relationship between sexually oriented adult entertainment businesses and negative secondary effects.

The research examined all 76 census tracts within the St. Paul region. They compared all tracts containing adult entertainment establishments with all of those that did not. The study compared levels of neighborhood deterioration, determined by examining crime counts, housing values, and market and legal influences over the study period, for study and control areas and maintained a substantial time lag between the first and second measures of deterioration. Changes in neighborhood climate between the first and second measures were considered reliable neighborhood changes rather than erratic fluctuations in social activity.

The study found no relationship between sexually oriented businesses and neighborhood deterioration. In fact, the study found that the only factor that was predictive of neighborhood deterioration was whether an alcohol-serving establishment operated within the area. No relationship was found to exist between neighborhood deterioration and the presence of establishments that both served alcoholic beverages and offered live nude entertainment.

The Los Angeles, California (1977) study is perhaps the most often incorrectly referenced of any empirical research investigating the effects of adult oriented businesses on surrounding areas. Similar to the Minneapolis study, although this study is the third most relied upon piece of research cited for establishing the relationship between adult oriented businesses and negative social repercussions, the researchers did not find any significant support for such a connection.

The first part of the study was based on the comparison of average property value changes for five study areas and four control areas. Each of the five study areas was chosen because it contained a known cluster of adult entertainment businesses. The four control areas were chosen because of their proximity and supposed similarity to at least one of the study areas, and because they did not have an adult entertainment business operating within their borders. All of the study and control areas were in Hollywood, North Hollywood, or Studio City.

In this part of the study, the researchers reported that it was difficult to find any consistent increase or decrease in property values associated with adult businesses. This result was based on comparisons that showed that while treatment and control areas both decreased in average value, there was a far larger decrease in the control (non-adult) area. Further, treatment (adult) areas increased in value by more than 400% over their comparable control (non-adult) areas. The researchers concluded that there is "...insufficient evidence to support the contention that concentrations of sex oriented businesses have been the primary cause of these patterns of change in assessed valuations between 1970 and 1976."

The second part of the Los Angeles study used survey results to establish that the public is strongly opposed to the operation of adult businesses. Importantly, the study did not obtain a random sample of respondents. Without adherence to this requirement, one cannot calculate an error rate and the reliability of the results cannot be determined.

The third part of the study consisted of an examination of the crime and population statistics for each of the census tracts containing clusters of adult entertainment businesses. Only tracts containing the clusters of adult businesses considered within the treatment areas for the first part of the study (discussed above) were considered. These data were then compared to those obtained from the census tracts containing each of the comparison control (non-adult) areas used in the first part of the study. Both sets of data were analyzed and compared over time in order to determine any significant

differences concerning crime rates. The authors concluded that in general, there were no significant differences in crime rates between the census tracts encompassing the treatment (adult) and control (non-adult) areas

The final part of the Los Angeles study involved a "special" police study of the areas of Hollywood containing clusters of adult entertainment businesses. However, the researchers failed to adhere to even the most basic and rudimentary professional standards by failing to attempt to make a comparison of crime statistics in these areas with those in comparable control (non-adult) areas. In addition, the researchers admitted to a substantial change in police surveillance of the area under study which could introduce significant bias to the study. The findings of this part of the study suggested high levels of criminal activity within the studied clusters

The Phoenix, Arizona (1979) study attempted to examine the relationship between adult entertainment businesses and local crime rates. This study claimed to find higher overall crime rates in study areas containing adult-oriented businesses compared to control areas containing no such businesses. The selection of treatment and control areas was problematic, as was the limited duration of the study period. Although the study findings suggested that overall crime rates were higher in each of the study areas than those for each matching control area, a composite index of "violent crimes," which included murder, robbery, assault, and rape, was also constructed. Each study (adult) area showed a lower rate of violent crime (including rape) than their matched control (non-adult) area. In addition, the rate of child molestation was higher in the control (non-adult) areas than in the matched study (adult) areas. The results of the study offered, at best, equivocal evidence of the relationship between crime rates and the operation of adult entertainment businesses.

The fourth study, in Indianapolis, Indiana (1984) is probably the report most widely cited by municipalities as evidence of negative secondary effects. The overall study offered equivocal findings regarding the supposed relationship between adult businesses and negative secondary effects. More importantly, in a sub area analysis most relevant to the question of the relationship between adult businesses and secondary effects, lower rather than higher crime rates were found in all treatment (adult business) areas compared to control (no adult business) areas. The study contained reports of four separate analyses, each with significant methodological problems that undercut its reliability. The most striking example of this was a survey that asked a national sample of real estate appraisers who were not from Indianapolis to consider only a hypothetical scenario concerning adult businesses in an unspecified community.

The Indianapolis report claimed to have found a substantially smaller increase in property values for the treatment areas relative to the control areas. However, the researchers failed to match adequately treatment and control areas for this analysis. The analysis compared the average home mortgage value and average number of homes sold for the control and study areas discussed in the first study, as well as those for the center township area. The study reported that the average mortgage value for

the control areas and central township area increased by 77% and 56% respectively, while the treatment areas saw only an average increase of 26%. However, vast differences in initial mortgage values associated with the failure to properly match control and study areas rendered the two areas far too dissimilar to be considered as suitable comparison groups.

The next six most frequently referenced studies in descending order were reports produced by: Austin, TX (1986); St. Paul, MN (1987/1988); Amarillo, TX (1977); Detroit, MI (1972); Beaumont, TX (1982); and, Kent, Washington (1982). The Beaumont, TX (1982) and Detroit, MI (1972) studies are not empirical. The Beaumont study, for example, is merely a report prepared by the planning department of that municipality, suggesting a need for regulation of adult businesses. The remaining four reports failed to meet one or more of the four necessary criteria established by the Court.

The studies produced by Austin, TX (1986), St. Paul, MN (1987/1988), and Amarillo, TX (1977) all failed to compare neighborhood characteristics (crime rates or property values) for areas containing adult entertainment businesses with control areas containing no such businesses. In addition, these three studies all failed to include measures of neighborhood characteristics over a sufficient period of time, both prior to and following the establishment of adult entertainment businesses.

In the following section, we survey academic studies of real estate appreciation that meet the scientific criteria established by the Court. Although these studies are not specifically designed to measure secondary effects associated with adult establishments, they provide theoretical contributions and precedents that validate the use of the model proposed to measure secondary effects presented later in the paper.

MEASUREMENT OF SECONDARY EFFECTS USING HOUSING PRICE MODELS

Temporal and spatial effects complicate the measurement of real estate appreciation. Heterogeneous temporal or spatial effects may violate basic assumptions typically required for unbiased and efficient estimation. Temporal effects include, for example, differential rates of obsolescence related to the age distribution of houses. Depreciation or obsolescence of the housing stock might occur at different rates related to housing characteristics at the beginning of the study period, the original value of the house, the specific amenities included in the housing package or other factors that are not accounted for in models that do not specifically account for intertemporal heterogeneity (Dombrow, Knight, and Sirmans 1997).

Spatial effects that influence house price appreciation typically violate the assumption of statistical independence of observations. If we assume that real estate prices are interrelated, e.g. the price of a parcel is influenced by characteristics of nearby parcels, we have admitted non-independence of our observations. Biased and inefficient parameter estimates will be obtained if spatial segments do indeed exist and are not accounted for (Can 1990, Can and Megbolugbe 1997).

Heterogeneous temporal or spatial responses to regional or national macroeconomic shocks also complicate empirical measurement of house price appreciation (Goetzman and Spiegel 1997). This is particularly important if distinct submarkets exist within local real estate markets. National or regional recessions might lead to increased unemployment or credit shortages that decrease demand differentially in different markets. Similarly, economic upturns will affect demand differently in different submarkets. If real estate submarkets are well-defined spatially, macroeconomic shocks will exhibit both temporal and spatial components.

Neighborhood (Submarket) Effects on House Price Changes

In their study of neighborhood risk factors and local home price appreciation and volatility, Li and Rosenblatt (1997) use Fannie Mae/Freddie Mac and 1990 U.S. Census data with a repeat sales methodology to construct annual census tract level home price appreciation in the Los Angeles-Long Beach, Oakland and Anaheim-Santa Ana PMSAs.[2]
 Modeling house price movements in two periods, 1986-90, and 1990-94, the authors find no consistent neighborhood effects across both periods and for all three metropolitan areas. Although, the authors conclude that their results show interesting evidence of distinct housing market sectors, they caution that their findings do not demonstrate that relative neighborhood performance is predictable with regard to price appreciation and volatility.

Archer, Gatzlaff, and Ling (1996) examine locational variation in the rates of price appreciation in Dade County (Miami), Florida, from 1971 to 1992. The authors rely on a generalized version of the standard repeat sales model to estimate annual house price appreciation in each submarket, relative to overall market appreciation. The authors find house price appreciation to be somewhat spatially related. They find that it varies by municipality, with distance from the central business district, and with local (census tract) changes in population, housing units, and ethnic mix. However, the authors caution that the explanatory power of these relationships are not strong and conclude that the effects of tract group location is dominated by idiosyncratic influences.

Using a large data set of repeat sales transactions in Montgomery County, PA., Crone and Voith (1999) examine the relationship between appreciation rates at the census tract level and the risk or uncertainty of that return. The repeat sales methodology addresses the problem associated with differences in the timing of sales. However, the resultant measure of variability does not capture the risk associated with differences in appreciation within a tract for a given period. To address this problem, the authors

---

[2] Li and Rosenblatt (1997) use nine neighborhood variables from the 1990 census to capture neighborhood risks factors. The authors limit their analysis to census tracts with at least ten transactions in each calendar year, 1986 to 1994 and with a minimum population of 1000 in 1990 to avoid unstable parameters.

estimate their model in two ways. First, they take into account the actual timing of sales. They estimate countywide yearly appreciation rates. On the basis of this estimation, the authors find a great deal of variation from year to year in estimated appreciation rates, which suggests that differences in the timing of sales across tracts could affect estimated appreciation.   Next, they construct yearly real appreciation rates for each tract. This allows them to address the problem that if a disproportionate share of sales in some census tracts occurs in periods of high real appreciation and the variation of appreciation rates is also higher in those periods, both the average appreciation and the standard deviation for those tracts will be high. The authors find that, for most characteristics of dwelling or households, it is the variation within a census tract that will increase the uncertainty about the expected appreciation.

Gyourko and Voith (1992) rely on error decomposition models to examine the relative importance of common national impacts and metropolitan area differences on price appreciation. The authors use time-series cross-sectional data on median existing home sales prices obtained from The WEFA Group. They construct four annual house price appreciation series by using the first quarter over first quarter levels, second quarter over second quarter levels, and so on. The authors have eighteen annual observations on price appreciation per local area beginning with 1971 and ending with the 89 period. The cross section is composed of observations on 56 of the largest MSAs. The authors find that the national economy strongly influences local housing markets, i.e., they find no city specific fixed effects in house appreciation rates over the study period. However, they do find evidence of unequal persistence in appreciation rates across MSAs, i.e., they find serial correlation in some local appreciation series. This suggests that there may be periods of local house price appreciation that diverge from national trends.

Gatzlaff and Haurin (1997) estimate the bias when information on sold properties is used to estimate appreciation rates for the whole stock, even for those houses that are not transacted. Using data from Dade County, Florida (1971-1995), the authors find significant bias in a house value index constructed using a repeat sales methodology.[3] They find the bias highly correlated with economic conditions in general and changes in nonagricultural employment in particular.[4]   Meese and Wallace (1997) reach similar conclusions using data from Oakland and Freemont, Ca. The authors use median, hedonic, repeat sales, and hybrid house price index models.[5] They find that appreciation rates estimated using the repeat sales methodology are not representative of all

---

[3]For additional studies on bias and estimation concerns regarding the use of repeat sales models see Kuo (1997); Steele and Goy (1977); Geltner (1997); Case, Pollakowski, and Wachter (1997); and Keil and Zabel (1997).

[4]Although not tested by the authors, this bias is likely to vary by neighborhood (submarket) if population growth, construction activity, employment rates, and changes in per capita income differ significantly by neighborhood.

[5]See Crone and Voith (1992) for another comparison of several house price models.

transactions in the housing market. In addition, they also find that the characteristic prices vary over time, i.e., they do not remain constant.

A number of studies have found strong submarket (neighborhood) effects. Can (1990) adapts Casetti=s (1972) expansion methodology to incorporate neighborhood externalities into the traditional hedonic housing price model. She uses 1990 data from the Columbus, Ohio MSA. Methodologically, the author finds that the models constructed using the expansion method, especially those that incorporate both spatial spillover effects and spatial parametric drifts, explain variations in urban house prices better than the traditional hedonic price models. In addition, Can finds that houses in deteriorated, neighborhoods are raised simply if they are in proximity to higher prices housing, regardless of the structural attributes of the houses themselves. This corroborates the importance of addressing the issue of spatial dependence (spatial autocorrelation) in house appreciation studies.

Can (1996) examines the presence of spatial segmentation, or different house price structures, on the basis of geographic location. She contends that if neighborhood effects enter as direct determinants of housing prices, like a premium, then one can assume a uniform housing market under investigation, since there will be one price schedule. In contrast, if neighborhood differentials lead to varying attribute prices, then one can assume the presence of independent price schedules, thus the existence of a spatially segmented market. Within a cross-sectional framework, Can uses both spatial switching regressions and expansion methodology as means of incorporating spatial variability in house price models within a hedonic framework. Using date from 3770 housing transactions in the Miami MSA in the third quarter of 1990, Can finds evidence of market segmentation. She finds that the spatial contextual expansion model with a quadratic trend has the best predictive power.

Goeztmann and Spiegel (1997) use a distance-weighted repeat sales model to estimate appreciation at the zip code level in the San Francisco Bay area from 1980 to 1994. In addition to the traditional distant measures, the authors incorporate property characteristics and neighborhood socio-economic variables in the estimation of a generlized least-square model. They find that house price appreciation rates at the neighborhood level (zip code) vary substantially within the San Francisco metropolitan area. They also find that, when distance is defined in terms of socioeconomic characteristics, median household income is the most important explanatory variable of the covariance of neighborhood housing returns. Overall, the authors conclude that using metropolitan area price indices is not appropriate to capture house price appreciation in a given neighborhood.

Can and Megbolugbe (1997) develop a house price index that addresses spatial autocorrelation problems. The authors use 1990 data from single family property sales in Dade County, Florida. They estimate and compare the traditional hedonic model with two alternatives appropriately corrected for spatial autocorrelation. They find that the corrected models result in better indices.

Finally, Quercia, McCarthy, Ryznar and Can (2000) develop a methodology to estimate differences in house price appreciation for homes in "underserved" tracts in Dade County, Florida. They estimate three variants of spatio-temporal repeat sales models to show the differences in annual house price appreciation rates between parcels in underserved and non-underserved census tracts. To correct for spatial autocorrelation, they incorporate spatial operators in their estimation. Accounting for spatial autocorrelation of house prices addresses, at least in part, the problems noted by other researchers regarding submarket effects.

METHODOLOGY AND DATA

In this paper we adopt the fixed-effects and "seemingly unrelated regression" expansion of the repeat sale methodology pioneered by Quercia, et al (2000) to estimate secondary effects associated with adult entertainment establishments. In this section, we describe this approach. We use this expanded repeat sales method to estimate annual housing appreciation rates for Mecklenburg County, NC (Charlotte metropolitan area) from 1975 to 1999. The model is then used to estimate the impact of proximity to adult establishments on house price appreciation rates—a direct measure of secondary effects.

There are three standard methods used in regresssion models for estimating models that account for temporal variation in parameters. These are fixed effects models, random effects models and Seemingly Unrelated Regression (SUR) models. The main difference between the methods involves how the estimated parameters are allowed to vary over time. In fixed effects models, it is assumed that intertemporal variation in parameters is captured in the intercept term. In random effects models, either the estimated parameters are allowed to vary randomly over time, or the random component of the model (e.g. the residual) is decomposed into time-specific and individual components. In SUR models, a multiple equation specification is used which allows separate parameters to be estimated for each time period. The error components of the equations are linked in the estimation process to account for the non-independence of the observations. As mentioned above, repeat sales methods are designed to capture intertemporal variations in appreciation.

Quercia, et al (2000) show that the fixed effects and SUR models perform well in estimating differences in appreciation rates in underserved areas of Dade County, FL. Following Quercia, et al, we use these models to estimate secondary effects of the location of adult establishments on real estate price appreciation in Mecklenburg County.

Methodological Approach

If we assume that yearly appreciation rates predictions using the repeat sales method are unbiased and relatively efficient, then it is possible to analyze the prediction error for individual dwellings in the same way that residuals are decomposed in the random or

fixed effects models mentioned above.[6] For this study, we need to account for spatial variation in appreciation rates once the time component is accounted for. Following Crone and Voith (1992), we estimated the real yearly housing appreciation rates for the entire sample. This uses the standard approach derived from the growth identity:

$$P_t = P_{t-k}\,\Pi_{i=1}^{k-1}(1+r_{t-i})$$

where: P_t = real market sale price of the house in year t
P_{t-k} = real market previous sale price of the house in year t-k
r_i = the rate of price appreciation between years i and i-1

Taking the natural log of both sides and rearranging yields the estimation equation:

$$lpr = \Sigma_{i=72}^{93}\,\beta_i\,D_i + \varepsilon$$

where: lpr = the natural log of the ratio of the last sale price and the previous sale price, e.g. $\ln(P_t/P_{t-k})$

D_i = a dummy variable taking the value 1 when i is between the sale years

As shown in Crone and Voith (1992), the estimated coefficients (β_i) will equal $\ln(1+r_i)$. The annual appreciation rate is easily solved for: $r_i = e^{\beta}_i - 1$.

The Afixed effect@ variant can be estimated by incorporating variables to stratify the sample. For the purposes of this paper, we will stratify the sample according to whether they are in close proximity to adult entertainment establishments to see if appreciation rates Ashift@ across strata. The estimation equation is modified as follows:

$$lpr = \Sigma_{i=72}^{93}\,\beta_i\,D_i + \gamma_i\,T_i\,D_i + \varepsilon$$

where: T_i = "Tarheel@ designation (=1 if parcel is close to adult entertainment establishment)
γ_i = the average shift in appreciation rates associated with parcel designation in year i

To fully account for spatial variation of house price appreciation, spatial operators were

---

[6]There are two underlying assumptions in repeat sales models: (1) semi-log form of the underlying hedonic regression, and (2) the same underlying hedonic coefficients from year to year.

included in the estimation. This involved calculating average annual house price appreciation for houses within a specific distance of the house in question. For this study, we chose a distance of one kilometer.

Operationalizing the Methodology

We operationalize the estimation in five steps. These are: (1) identification of real estate parcels in close proximity to adult entertainment establishments, (2) computation of the spatial operators, (3) estimation of the traditional repeat sales model, (4) estimation of the Afixed effect@ model parcel designation and the spatial operator; and, 5) joint estimation of the SUR model.

Identifying parcels. Using tract-level data provided by Mecklenburg County we were able to identify the location of twenty adult establishments. We then identified all parcels within various linear distances of the establishments.

Computation of spatial operators.   We computed the spatial operator as the average annual appreciation of units sold within one kilometer (km) of a given parcel.[7] The appreciation rate was computed for each individual parcel and then averaged for all homes within the specified distance (areas). Only parcels with at least two sales transactions during the study period were included in the estimation. Because the parcels in the sample had a wide distribution of periods between sales, and because parcels had been bought and sold at different times within the study period, it was necessary to express the average appreciation in annual real terms.

All sales prices were expressed in constant dollars using the CPI-U provided by the Bureau of Labor Statistics. Annual real price appreciation (APA) between sales is expressed in annual terms using the following equation:

APA = [log(RP_2/RP_1)]/ (months between sales)

where: RP_2 = real price at time of second sale, and
RP_1 = real price at time of first sale.

All of the homes within the specified distance, calculated using a linear distance formula based on longitude and latitude coordinates, were determined for the entire sample. The mean APA for these homes was then determined for each distance metric.

Estimation of the traditional repeat sale model. The traditional repeat sales model was estimated for all units in the sample. That is, we estimated:

---

[7]That is about 0.621 of a mile. Results using 0.5km and 3 km spatial operators were also estimated but are not reported in this paper.

Log P_2/P_1 = D1980 + D1973 +...+ D1999 + e

Spatial operators were added to the model. The results of this model are presented in Table 2.

Estimation of the ʌfixed effects@ model. To capture different appreciation rates for parcels near adult establishments the fixed effect model is estimated. A set of variables based on the tract designation are added interactively to the repeat sales model. The T variables capture the average annual shift in appreciation rates for parcels located within the designated distance of adult clubs. Spatial operators (SOd) are added to the model as well. That is, we estimated:

Log P_2/P_1 = D_i + T_x *D_i + SO_d + e

where: i = 1980, 1981..., 1999
X = parcel designation
d = spatial operators (1 km)

These estimates are presented in table 3.

Estimation of the SUR model. To capture different dynamics in appreciation rates for parcels near adult establishments the SUR model is estimated. A two equation repeat sales model is estimated simultaneously, linking the equations through the error structure. The T variables capture the average annual shift in appreciation rates for parcels located within the designated distance of adult clubs. Spatial operators (SOd) are added to the model as well. That is, we estimated:

(equation 1) Log P_2/P_1 = D_{ix} + SO_{dx} + e1
(equation 2) Log P_2/P_1 = D_{ix} + SO_{dx} + e2

where: i = 1980, 1981..., 1999
X = parcel designation
d = spatial operator (1 km)

These estimates are presented in tables 4.

Data

Three sources of data were included in the analysis: tax assessment information from Mecklenburg County, North Carolina; US Census data, and data from the Bureau of Labor Statistics. Tax assessment data include housing characteristics, housing locations and sale prices for all residences in the county. Only single family detached dwellings transacted twice between 1980 and 1999, and held a minimum of two years were included in the analysis. The final sample consists of 64,619, or about 25 percent of all dwellings in the county. It should be noted that, with regard to sales transactions, only

information on the last two transactions were available. For instance, if a unit was sold in 1980, 1982, 1983, and 1998, only information on the 1983 and 1998 transactions is available.[8]

Census tract level data include average socio-economic characteristics, racial/minority distribution of the population, and housing size and prices in the tract for 1990. This information is used to describe areas in which adult entertainment establishments are located. Data on consumer prices were obtained directly from the US Bureau of Labor Statistics. Using the so-called Tiger files from the US Census, every property was geo-coded and the corresponding census tract level data were matched to each property record. All nominal dollar values were deflated using the CPI-U.

Ultimately, each record in the sample includes the most recent and previous sale price, the dates of the sales, parcel characteristics, and exact location. Parcel characteristics include living area, land area, number of bedrooms, number of baths, and age of the house. The location of the parcel is determined on several levels--census tract, nine-digit zip code, exact longitude and latitude coordinates of the structure, and the type of underserved tract (if any). Summary statistics for the sample are presented in Table 1.

Table 1 presents key parcel characteristics in the sample. About 64,619 units are included in the sample. Of these units, 6,249 are located within 1 km of adult clubs and 25,264 are located within 3 km.

Overall, Table 1 indicates that transacted houses near adult clubs tend to be smaller than transacted houses in Mecklenburg county as a whole. Houses in close proximity to adult clubs are more likely to be older, smaller, and be located on smaller lots. This is expressed in the appraised value which is considerably lower ($102,277) than for the sample as a whole ($148,557). Finally, units in underserved areas are transacted less often than units in general having a slightly longer duration of time between sales.

ECONOMETRIC RESULTS

Econometric results are presented in this section. First, we present the estimates of the traditional repeat sales model to provide a baseline measure (Table 2). These results incorporate spatial control in the form of the one kilometer spatial operator. Next, we present the results of estimating the Afixed effect@ (Table 3) that allow us to capture both the temporal and spatial dimension of house price appreciation. The fixed-effects model allows us to capture annual shifts in appreciation rates associated with proximity to adult establishments. Finally, the SUR model is estimated to show differences in annual appreciation rates over time for houses that are near to adult establishments and houses that are not near the establishments.

---

[8]There is one exception to this rule. When the dataset lacked complete information on the transaction before last, the last transaction with complete information was used instead.

Traditional Repeat Sales Estimation

Estimates of annual inflation-adjusted appreciation rates from the traditional repeat sales model are presented in Table 2. They are also exhibited graphically in Chart1. The rates vary dramatically from year to year, with a high over 17% in 1982 and low below -9% in 1981. The intertemporal variation generally corresponds with macroeconomic fluctuations. Negative rates coincide with the recessions of the 1980s and the credit crunch of 1989-1991. Positive rates coincide with the more robust markets of the1990s.

The parameter estimates in Table 4 are generally statistically robust as well. More than half (13) of the 20 coefficients are statistically significantly non-zero at the .05 level.[9]

Fixed-Effects Model

Analogous to the estimation of fixed effects models, the dummy variables designating whether a house is close to an adult club were added interactively to the regression reported in Table 1 . The estimated coefficients for the appreciation rates appear in column (2) of Table 2. Estimation of the effect of proximity to the adult clubs is presented in column 3.

In almost all of the 20 years under study, houses near adult clubs, exhibit distinctly different appreciation patterns from the overall sample. More narrowly, houses near the adult clubs appreciate at the same or higher rate in eleven of the twenty years. Houses near adult clubs appreciate at lower rates in nine of twenty years. The price swings associated with proximity to the adult clubs is startling. For example, in 1982 houses appreciated on average 47.2% less than the sample overall. Similarly, house prices rose by 38.2% more than the overall sample in 1983.

The 1980s were a far more turbulent time for housing investment in all cases, but it appears that the volatility of house prices in areas around adult clubs is magnitudes higher during this period. The appreciation patterns show more severe Aextreme events@ for housing near adult establishments than in the market as a whole. The same characteristic was exhibited by "underserved" tracts in Dade county from 1973-1992 as shown in Quercia et al (2000).

---

[9]It is not clear whether *statistical* significance is directly relevant, given that real appreciation rates around zero are not unexpected.

SUR Model

Results similar to the fixed effects model presented above are revealed in the SUR model whose estimated appear in Table 4. Parameter estimates are presented in Chart 2. Here the annual appreciation rates are estimated for houses close to adult clubs and those not close to adult clubs separately. As is readily apparent, the appreciation rates for homes near the clubs often exceed appreciation rates for homes further away. There is extreme volatility of house prices during the 1980s, especially for homes near adult clubs. Price movements settle down for all homes during the 90s when appreciation rates near adult clubs generally outperform those at greater distances.

DISCUSSION

The model developed and estimated here employs a widely used method for evaluating the performance of house prices. The repeat sales methodology is the method most widely used to evaluate collateral values and expected appreciation by mortgage lenders and secondary markets. Automated underwriting and automated valuation models rely on repeat sales data to originate mortgages nationwide. The validity of the modeling method has been established through peer-reviewed research published in leading housing research journals.

The model is estimated using an extensive, publicly available data set. The data captures all marketing activity for properties in Mecklenburg County, North Carolina for two decades. Thus, the study presented here meets the requirements established by the Court for admissibility of scientific evidence.

The estimations indicate that price appreciation rates for housing near adult clubs are at least as high as those further away in eleven of the twenty study years. While average appreciation rates for the whole period were slightly lower for housing near clubs, this was attributable to astounding price declines in the recession of 1982 and the credit crunch of 1990. These extreme price movements are usually associated with market speculation and the finance needs on the demand side of the particular submarkets. For example, similar extreme price movements have been identified in low-income and minority housing submarkets in other studies previously discussed.

One strength of the study is its comprehensive nature. Unlike other studies that have attempted to measure secondary effects by choosing matched pairs of locations within metropolitan areas, this study uses the entire metropolitan area as its study frame. Study controls are built into the statistical estimation method. So rather than having to defend the choice of treatment and control areas, the study establishes its own treatment and control groups using the entire metropolitan area as its sample.

The results of the study are consistent with the empirical results of the oft-cited studies of negative secondary effects discussed above. In almost every study discussed, the secondary effects associated with adult establishments are inconclusive. However, this

19

is a rather conservative reading of the results. One might make the argument that there is evidence from the other studies, evidence that is validated in this study, that there are *positive* secondary effects associated with proximity to adult establishments.

While the existence of positive secondary effects might seem an absurd claim, an argument might be made that the location of adult establishments is non-random. The non-randomness might be associated with the same non-randomness that leads to the location of other undesirable activities (for example, junkyards, mobile home parks, other noisy or dirty production activities) to areas with inexpensive properties. Low priced properties might provide higher than average returns, especially as urban sprawl or development limits make the areas more desirable development locations.

CONCLUSIONS

In this study, we examined spatio-temporal measurement of house price appreciation for housing located near adult entertainment clubs. We applied a Afixed effects@ and a ASURA variant of the repeat sales model to estimate the impact of location near a club. We also controlled for spatial autocorrelation using by incorporating a spatial operator in the estimation equations.

Overall, we find that houses near adult clubs exhibit different annual price apprecation profiles than houses in the overall market. Similar to the findings of Quercia, et al (2000), who found high price volatility for housing in low income and high minority areas, we find that housing near adult clubs had high price volatility during the 1980s, after controlling for temporal and spatial effects. This made the housing a riskier investment and probably led to speculation on housing in these submarkets during the period.

The study

These findings should be taken with caution. First and foremost, there is no theoretical causal association between housing prices and proximity to adult clubs. These results suggest that larger forces, e.g. macroeconomic swings, are at work determining the value of housing.

Second, the repeat sales method for estimating price appreciation uses very little information on dwelling types or changes in dwellings to explain appreciation. However, the method presented here (adding controls for spatial effects interactively) is a simple and powerful way to measure the investment value of housing over time and across space.

A hybrid hedonic price/repeat sales model might shed more light on other reasons for the variation in returns. These methods can be used to capture the effects of housing features and neighborhood characteristics on appreciation. It would be interesting to

compare the results of the hedonic method versus the repeat sales method in a similar way to the work of Crone and Voith (1992).

Finally, the analysis presented here is limited to one county in one metropolitan area. Thus, the results may not be generalizable to other parts of the country. We intend to replicate the analysis with data from other metropolitan areas. This is necessary before the study findings can be generalized to explain the dynamics of price appreciation with respect to adult entertainment establishments.   For instance, below average appreciation may be the result of unavailability of credit in certain areas. Similarly, below average appreciation might be the result of low demand for the type of housing and services in areas near clubs. As was demonstrated, housing near the clubs tended to be smaller and less expensive. Prices for these houses might follow the fortunes of the population in the market for this type of housing.

Since a core set of studies have been, and continue to be, relied upon by hundreds of local municipalities as evidence of negative secondary effects, a central concern must be the methodological rigor, and therefore trustworthiness, of these studies. This is particularly true given the precedent the Supreme Court established that a municipality must show that such regulations are necessary to further the governmental interest of ameliorating secondary effects.

In this article we have indicated that there is reason to challenge the assumption made by communities across the United States that past studies of secondary effects show an empirical relationship between adult businesses and negative effects. There is also no legitimate basis for extending the secondary effects doctrine to the regulation of expression within adult businesses based on these studies. The study has provided a method for measuring secondary effects of proximity to adult establishments. Application of the method shows no evidence that negative secondary effects on house price appreciation can be found in two decades of housing transactions in Mecklenburg County, North Carolina. City councils, municipalities, and the courts might be best served by the using similar methods, based on sound scientific standards, to assess the impact of adult establishments in their locales.

REFERENCES

Anselin, Luc. 1988. Spatial Econometrics Methods and Models. Dordrecht, Boston: Kluwer Academic Press.

Archer, Wayne R., Dean H. Gratzlaff, and David C. Ling. 1996. Measuring the Importance of Location in House Price Appreciation. Journal of Urban Economics 40:334-53.

Bryant, Paul, Daniel Linz, and Bradley Shaferá. 2000 "Government regulation of 'adult' businesses through zoning and anti-nudity ordinances: Debunking the legal myth of negative secondary effects" *Communication Law and Policy*: August 21, 2000

Can, Ayse. 1996. Spatial Segmentation in Urban House Prices: Alternative Approaches. Washington, DC: Fannie Mae Foundation. Mimeo.

Can, Ayse. 1990. The Measurement of Neighborhood Dynamics in Urban House Prices. Economic Geography 66:254-72.

Can, Ayse and Isaac Megbolugbe. 1997. Spatial Dependence and House Price Index Construction. The Journal of Real Estate Finance and Economics 14(2): 203-222.

Case, Bradford, Henry O. Pollakowski and Susan M. Wachter. 1997. Frequency of Transaction and House Price Modeling. The Journal of Real Estate Finance and Economics 14(2): 173-188.

Case, Bradford, Henry O. Pollakowski and Susan M. Wachter. 1991. On Choosing Among House Price Index Methodologies. AREUEA Journal 19(3): 286-307.

Case, Bradford and John M. Quigley. 1991. The Dynamics of Real Estate Prices. The Review of Economics and Statistics. 73:50-58.

Case, Karl E. , and Robert J. Shiller. 1989. The Efficiency of the market for Single-Family Homes. American Economic Review 79(1): 125-137.

Casetti, E. 1972. Generating Models by the Expansion Method: Application to Geographical Research. Geographical Analysis 4:81-91.

Clapp, John M. and Carmelo Giaccotto. 1999. Revisions in Repeat Sales Price Indexes: Here Today, Gone Tomorrow? Real Estate Economics 27(1):79-104.

Crone, Theodore M. and Richard P. Voith. 1992. Estimating House Price Appreciation: A Comparison of Methods. Journal of Housing Economics 2:324-338.

Crone, Theodore M. and Richard P. Voith. 1999. Risk and Return within the single Family Housing Market. Real Estate Economics 27(1): 63-78.

Dombrow, Jonathan, J.R. Knight, and C.F. Sirmans. 1997. Aggregation Bias in Repeat-Sales Indices. The Journal of Real Estate Finance and Economics 14(2): 75-88.
Gatzlaff, Dean H., and Donald R. Hurin. 1997. Sample Selection Bias and Repeat-Sales Index Estimates. The Journal of Real Estate Finance and Economics 14(2): 33-50.

Geltner, David. 1997. Bias and Precision of Estimates of Housing Investment Risk Based on Repeat-Sales Indices: A Simulation Analysis. The Journal of Real Estate Finance and Economics 14(2): 155-172.

Goodman, Allen C. 1988. An Econometric Model of Housing Price, Permanent Income, Tenure Choice and Housing Demand. Journal of Urban Economics 23:327-353.

Goetzmann, William N., and Matthew Spiegel. 1997. A Spatial Model of Housing Returns and Neighborhood Substitutability. The Journal of Real Estate Finance and Economics 14(2): 11-31.

Gyourko, Joseph, and Richard P. Voith. 1992. Local Market and National Components in House Price Appreciation. Journal of Urban Economics 32:52-69.

Jansma, L., Linz, D., Mulac, A. & Imrich, D. (1997). Menís Interactions with Women after Viewing Sexually Explicit Films: Does Degradation Make a Difference? *Communication Monographs, 64, 1,* March .

Kiel, Katherine A., and Jeffrey E. Zabel. 1997. Evaluating the Usefulness of the American Housing Survey for Creating House Price Indices. The Journal of Real Estate Finance and Economics 14(2): 189-202.

Kuo, Ching-long. 1997. A Bayesian Approach to the Construction and Comparison of Alternative House Price Indices. The Journal of Real Estate Finance and Economics 14(2): 113-132.

Li, Ying and Eric Rosenblatt. 1997. Can Urban Indicators Predict Home Price Appreciation? Implications for Redlining Research. Real Estate Economics 25(1):81-104.

Linz, D. & Malamuth, N.M. (1993). *Communication Concepts 5: Pornography*. In S. Chaffee (Ed.) *Communication Concepts Series*, Sage Publications, Newbury Park, CA.

Manchester, Paul B. 1998. Characteristics of Mortgages Purchased by Fannie Mae and Freddie Mac: 1996-97 Update. U.S. Department of Housing and Urban Development, Office of Policy Development and Research. Working Paper No. HF-006.

Meese, Richard A. and Nancy E. Wallace. 1997. The Construction of Residential Housing Price Indices: A Comparison of Repeat-Sales, Hedonic-Regression, and Hybrid Approaches. The Journal of Real Estate Finance and Economics 14(2): 51-74.

Pollakowski, Henry; Michael A. Stegman, and William B. Rohe. 1991. Rate of Return on Housing of Low and Moderate Income Owners. American Real Estate and Urban Economics Association Journal 19(3):417-25.

Quercia, Roberto; George McCarthy, Rhonda Ryznar, and Ayse Can. 2000. Spatio-Temporal Estimation of House Price Appreciation in Underserved Areas. Journal of Housing Research (forthcoming).

Rothenberg, Jerome; George C. Galster; Richard V. Butler; and John R. Pitkin. 1991. The Maze of Urban Housing Markets. Chicago: The University of Chicago Press.

Smith, Lawrence B., and Michael H.C. Ho. 1996. The Relative Price Differential between Higher and Lower Priced Homes. Journal of Housing Economics 5:1-17.

Steele, Marion, and Richard Goy. 1997. Short Holds, the Distributions of First and Second Sales, and Bias in Repeat-Sales Price Index. The Journal of Real Estate Finance and Economics 14(2): 133-154.

Table 1.   Description of Sample

	all units n=64,619		units within 1 km of clubs n=6249		units within 3 km of clubs n=25264	
	mean	std	mean	std	mean	std
Average annual appreciation	3.60%	15.57%	3.41%	10.17%	3.47%	12.44%
years between sales	6.1	3.6	6.4	3.9	6.4	3.7
heated sq. feet	1,851.6	868.1	1,405.7	468.7	1,550.5	616.9
taxable acres	0.11	1.66	0.02	0.29	0.03	0.84
appraised value	$148,557	$118,950	$102,277	$50,829	$120,968	$96,212

Table 2   Baseline Repeat

Year	Annual appreciation Rate
1980	**-7.09%**
1981	**-9.38%**
1982	**17.32%**
1983	-0.06%
1984	4.94%
1985	**8.48%**
1986	**6.34%**
1987	2.95%
1988	**4.67%**
1989	**4.77%**
1990	**-4.74%**
1991	**-5.96%**
1992	-1.09%
1993	3.61%
1994	**4.30%**
1995	1.66%
1996	3.06%
1997	**12.31%**
1998	**8.13%**
1999	3.17%
spatial operator	26.59%

numbers in bold are statistically significant at .05 level

Table 3   Annual appreciation rates for single family units
           including effect of proximity to adult clubs

Year	Annual appreciation Rate	Effect of proximity to adult club	
1980	-5.66%	-0.98%	lower
1981	**-11.30%**	**16.27%**	higher
1982	**22.83%**	**-47.16%**	lower
1983	-4.44%	**38.18%**	higher
1984	**6.59%**	**-12.16%**	lower
1985	**10.61%**	**-20.33%**	lower
1986	**5.54%**	**6.99%**	higher
1987	4.42%	**-11.96%**	lower
1988	3.77%	**7.54%**	higher
1989	**5.10%**	-6.50%	lower
1990	-3.74%	-1.06%	lower
1991	**-6.24%**	3.74%	higher
1992	-0.83%	0.10%	same
1993	2.88%	3.43%	higher
1994	3.83%	**7.69%**	higher
1995	1.79%	-1.79%	lower
1996	2.69%	**4.37%**	higher
1997	**12.14%**	**4.19%**	higher
1998	**7.95%**	-1.38%	lower
1999	-0.23%	0.65%	higher
spatial operator	**0.26668**		

numbers in bold are statistically significant at .05 level

Table 4   Comparing Appreciation Rates:
               Units near clubs vs. Units not near clubs

Year	not near	near	
1980	-5.66%	**-6.80%**	lower
1981	**-11.30%**	4.44%	**higher**
1982	**22.84%**	**-24.69%**	**lower**
1983	-4.44%	**33.34%**	**higher**
1984	**6.60%**	**-5.82%**	lower
1985	**10.61%**	**-9.78%**	lower
1986	**5.54%**	**11.71%**	**higher**
1987	4.43%	**-7.29%**	lower
1988	3.77%	**11.04%**	**higher**
1989	**5.11%**	-1.41%	lower
1990	-3.74%	**-15.15% lower**	
1991	**-6.24%**	-2.51%	higher
1992	-0.82%	-1.29%	same
1993	2.89%	6.05%	higher
1994	3.85%	**11.22%**	**higher**
1995	1.80%	0.03%	same
1996	2.71%	**6.55%**	**higher**
1997	**12.16%**	**15.50%**	higher
1998	**7.96%**	**6.45%**	lower
1999	-0.22%	0.30%	higher
spatial operator	**26.49%**	**42.83%**	

numbers in bold are statistically significant at .05 level

Chart 1.

Annual Appreciation Rates
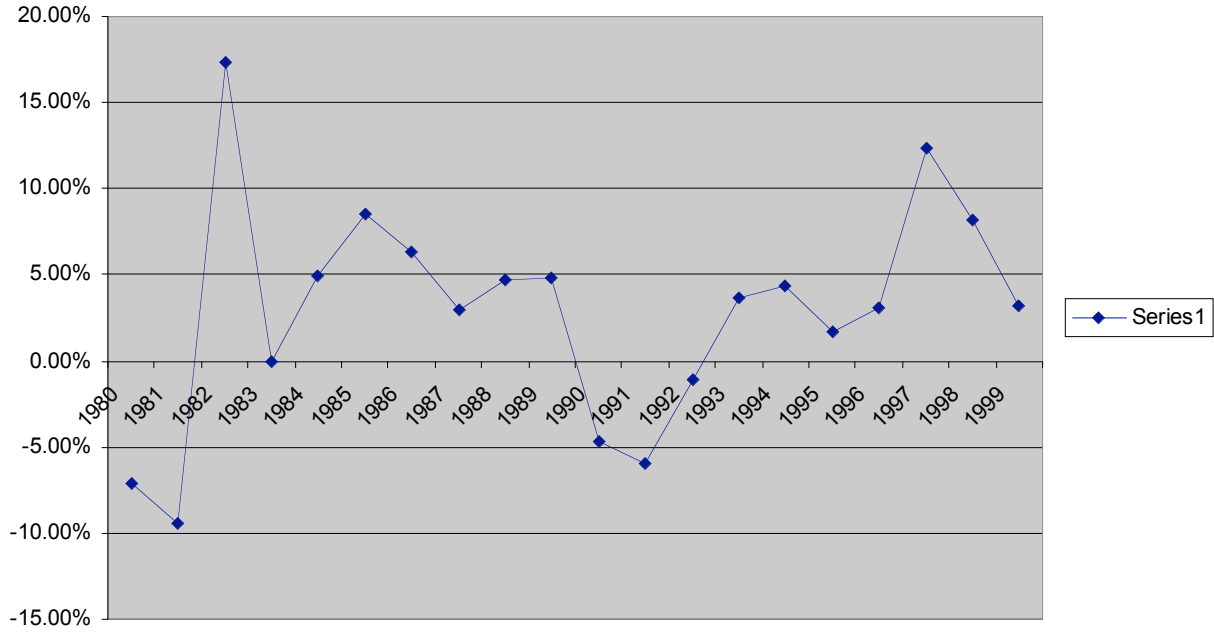**all single family units in Mecklenburg County 1980-1999**

Chart 2.

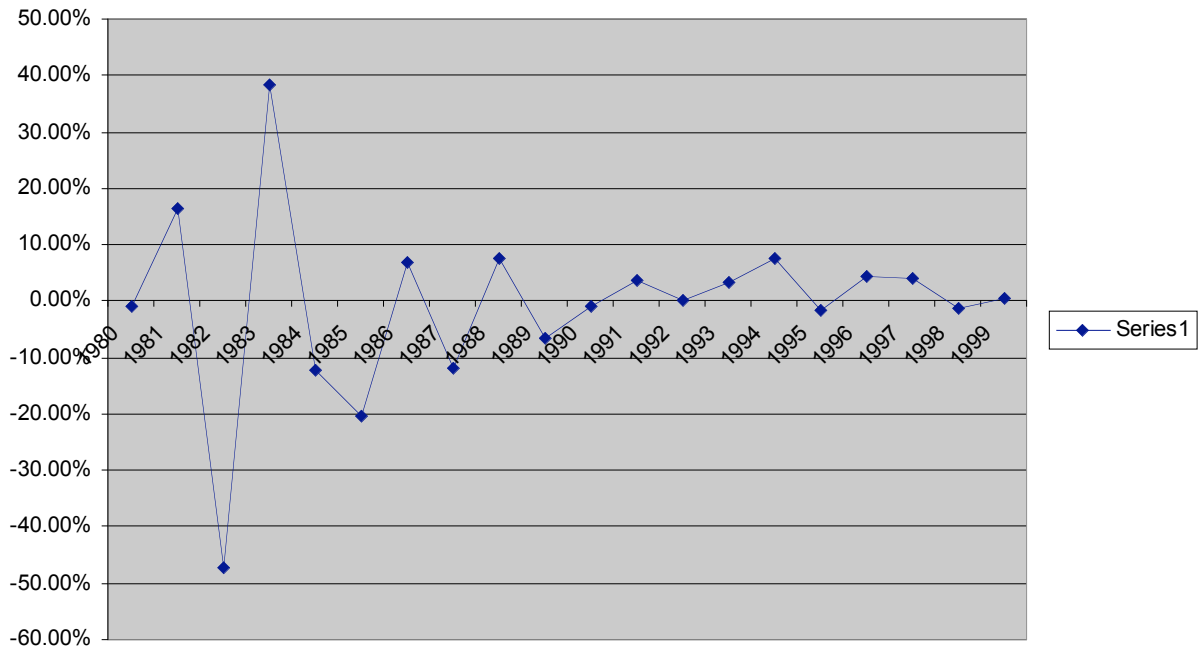**The Effect of Proximity to Adult Clubs**

Chart 3.

Comparing Annual Appreciation Rates
Near clubs vs. not near clubs