COMMERCIAL DEVELOPMENT SPILLOVER EFFECTS UPON RESIDENTIAL VALUES

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ABSTRACT

There is lack of consensus in the literature that nearby commercial land uses create negative spillover effects on residential values. Nevertheless, the Texas legislature began to require state chartered commercial improvement districts to set aside "mitigation funds" in order to compensate surrounding areas for potential negative externalities. The first district in which this order was imposed was the Town Center Improvement District (TCID) of The Woodlands in Montgomery County, Texas. This paper examines the extent to which such net negative impacts, in fact, exist. In doing so, the study sheds additional light on the nature of commercial development externalities, especially for large, centralized, commercial developments which have not been studied in the past. This study confirms what a few others have found for smaller developments, that commercial developments produce both positive and negative effects on residential areas which on net produce a rough quadratic relation between home values and proximity. The analysis finds that the net impact on all properties in the impact area is positive, but the positive impact is observed to fall with accessibility from its highest level at around a half mile from the district's boundaries. While all residential property owners appear to be net gainers, if "mitigation funds" continue to be required, the results reported here suggest that they should be concentrated on the areas that are extremely close to these large commercial districts. *JEL Classifications: R11, R12.*

INTRODUCTION

For decades, concern over residential market impacts from nearby non-conforming land uses has been discussed in a wide array of academic literatures and in hosts of political forums and debates. Such potential negative spillover effects are the primary rationale for zoning in many American cities is an effort to "protect" residential neighborhoods from these types of spatial externalities. While the greatest concern appears to involve the potential conflict between industrial and residential land uses, public policies typically extend to a broader array of potential conflicts, including negative spillover effects emanating to residential areas from non-industrial commercial developments.

The purported policy goals are to restrict and isolate commercial development from immediate proximity to residential areas. Besides zoning, which typically tries to distance these land uses from residential areas, buffers are sometimes required by public sector entities to form natural or artificial barriers to protect nearby residents from the noise, traffic, excessive night lighting, and aesthetic deterioration generated from commercial activity. Where explicit government intervention doesn't exist, the private sector itself often attempts to minimize land use conflicts. For example, developers of "master-planned" communities typically set aside commercial reserves in such a way as to maximize the convenience of the commercial development (hence the value of potential commercial properties) while minimizing the negative impacts on residential properties in close proximity which might lower the value of the residential lots to be sold.[1]

While the majority of the studies on the impact of land use regulations find nonresidential land uses to have at least some negative effects on residential values[2], the overall empirical literature must be characterized as mixed, especially with respect to commercial land uses. Some of the literature infers without much empirical evidence that the nature and extent of spillover impacts might be related to the size of a commercial development, its density or the nature of its borders. Clearly not all commercial development is the same. Some are strung out along a single transportation corridor, while others encompass large acres of land within well defined borders. A small commercial establishment may not have the negative consequences that a large regional mall might have, and a regional mall's impact may be smaller than that of a full sized mixed-use commercial center. Yet, these employment and commerce sub-centers have become a common fixture in contemporary suburban development, which can internalize many of the potential agglomeration economies associated with mini-CBDs (Central Business Districts). In many states, these sub-centers have become a part of commercial improvement districts. This is especially true in Texas, where most suburb development occurs outside the boundaries of incorporated municipalities which would otherwise have provided the infrastructure needed to support it.

Particularly popular for promoting commercial centers are legislatively approved improvement districts, also known as self-taxing districts. These districts provide a mechanism in which property owners agree to pay some form of taxes to the district in return for district specific services and amenities. As a consequence, the tax revenues are totally internalized within the district without leakages to outside jurisdictions. In Texas, there has been a substantial proliferation of such districts over the past 20 years which has had a profound effect upon the concentration of major commercial centers in the suburbs.[3] However, the Texas State Legislature, which authorizes these special improvement districts, has been caught up in the traditional concerns of external impacts of non-conforming land uses and has added a new policy twist to government intervention to ameliorate these externalities. Beginning in the 1990s, improvement district charters have typically required each district to set aside "mitigation funds" in order to compensate surrounding areas for potential negative externalities and provide resources to minimize the consequences. The first example of such mandated funds was associated with the charter for the Town Center Improvement District (TCID) of The Woodlands in Montgomery County, Texas. The TCID collects a 1% sales tax on all sales in the district for its own internal purposes, but was required to set aside 10% of its revenues to be used toward the mitigation of the net negative impact the development might have within 2 miles of its borders.[4]

This legislative mandate poses an interesting question about the spillover effects of commercial development because of the size of the development involved. The Town Center is more than just a large regional retail shopping center. While a sizeable portion of the Town Center consists of The Woodlands Mall, the TCID also includes major entertainment venues, hospitality and convention facilities, and a substantial amount of office space. Overall, the TCID includes nearly 5 million square feet of office space and nearly 7 million square feet of retail and other types of commercial space. The area, whose borders are precisely defined, supports over 30,000 jobs. Surrounding the TCID inside The Woodlands overall master-planned community are more than 30,000 residential units. Thus, the TCID is not merely a large regional shopping center, but is a fully integrated suburban satellite central business district with a large economic base of its own.

An obvious concern to state policy makers was that the sheer size of the TCID might greatly increase the likelihood of negative spillover effects created by its presence due to traffic, aesthetic deterioration, and increased local crime which is often attracted by commercial development. While the overall net economic benefits to southern Montgomery County could be argued to be positive in terms of accessibility to shopping and growth in local jobs, there remained the possibility that residential areas in close proximity to the TCID might actually experience a net negative impact.

The purpose of this study is to examine the TCID experience in order to shed light on the untested hypothesis posited in the literature that while small local commercial development appears to have only a small impact on nearby residential properties, the impact of a "mega center" might be significantly greater. This study also examines whether a large development might have a broader geographic impact beyond the meager few hundred feet which has been found with the smaller developments. In analyzing the spatial patterns of such impacts and the geographic extent of what might be called the "impact area", this study also examines the likelihood of dual positive and negative impacts upon surrounding residential areas as has been documented in a few past studies.[5] Like most empirical work in the literature, this study assumes that either positive or negative impacts will be capitalized into the value of surrounding residential properties and that such impacts are related to proximity to the development in question. Section II reviews the empirical literature regarding non-conforming land use impacts. Section III discusses the data and methodology used in this particular study. Section IV summarizes the empirical results, and Section V provides a brief summary.

LITERATURE REVIEW

Both the economics and real estate literatures are filled with studies estimating the pecuniary impact on residential properties of potentially negative neighborhoods effects, including close proximity to non-conforming land uses. Most use some form of hedonic analysis to isolate such impact from the myriad of other determinants of property values. One of the first studies to document negative effects of commercial and industrial land uses upon home values and apartment rents was the work of Kain and Quigley (1970). Not all studies, however, find significant negative impact of nonresidential land uses upon home values, though proximity to industrial land uses is almost universally found to have a deleterious effect (See Grether and Mieskowski (1980)). In addition to industrial land use impacts, Stull (1975) also finds a quadratic relationship between home values and the amount of commercial development in an overall residential area. In that study, small amounts of commercial development were actually found to be a positive, while larger amounts (in excess of 5% of the total neighborhood land) were found to have statistically significant negative impact upon home values. Some studies also conclude that the size of a particular commercial development can be important in affecting neighboring home values. Song and Knaap (2004), found no negative impact from commercial development, but they warned that larger commercial development might produce impact.

One reason past empirical research has produced mixed results is that they have typically failed to recognize the extremely localized character of the impact. This point was made by Tideman (1970) and is referred to by Grether and Mieskowski (1980) as the "next door" phenomenon. Thus, proximity may have to be defined in terms of such short distances as adjacent to or within feet of such factors producing noise, undesirable views, or excessive traffic. For example, the limited geographic extent of non-conforming externalities is demonstrated by Hughes and Sirmans (1992) who found that traffic generated by commercial activity only produced negative home value impact if it directly involved an increase in traffic intensity on the streets on which the homes were located. On the other hand, increased traffic on major neighborhood arteries appeared to have no measurable impact upon home values. Thus, size and distance do seem to be an important factor in affecting potential impact.

In one of the more interesting studies in the literature, Li and Brown (1980) focus upon both the positive and negative impacts of commercial development on residential property values. They cite the potential negative effects associated with aesthetics and pollution (mostly noise pollution) at the same time they consider the positive aspects of "accessibility". These positive external effects are associated with close proximity to shopping and other developmental amenities including nearness to work places. Their findings suggest that home values within a third of a mile from industrial land uses fall with proximity to the industrial sites, but beyond a third of a mile values actually increase with closeness, presumably due to the amenity of being closer to a large employment base. For commercial developments they also find that there is a negative "externality effect" and a positive "accessibility effect", but that the positive accessibility effect in all locations outweighs the negative externality effect.

On the other hand, Colwell, Gujral and Coley (1985) find that within 1500 feet (about a third of a mile) property values decline with increased proximity to a newly constructed shopping center, while those beyond 1500 feet actually gain in value with increased closeness. Similarly, Thibodeau (1990) analyzes the impact of a single high-rise office building on nearby houses in a small residential area of North Dallas and finds that homeowners with properties located between 1,000 and 2,500 meters away benefit from the high-rise while the homeowners within 1,000 meter distance are negatively affected by the building.

Contrary to the studies mentioned above, Song and Knaap (2004) find that housing prices increase with their proximity to neighborhood-scale commercial land uses and that an additional premium exists when the neighborhood store is located within walking distance. The authors caution though that the larger or more intense the commercial development, the more it can have a negative effect on housing prices.

Instead of analyzing direct distance to a commercial site, Paterson and Boyle (2002), examined the impact on home prices of direct visibility of such land uses. In their study these researchers conclude that "visibility of development significantly detracts from property values." That is, the development appeared to be a neutral attribute as long as it could not be seen from residential properties. This finding suggests that land use conflicts might be ameliorated by the use of buffers and that negative externalities are typically a "next door" phenomenon where now "next door" has a specific meaning - the non-conforming land use must be seen from the residential property in question.

In summary, the literature on the impact of commercial development upon nearby residential areas indicates that proximity to commercial developments may have a negative impact upon nearby residential properties, but that the impact is likely dependent upon the size of the development, the degree in which proximity is ameliorated by buffers to minimize visibility, and the extent to which the negative externality is partially mitigated by the benefits of being close to shopping and employment. This research generally finds little or only modest impact which extends out no more than a few thousand feet from the commercial sites. However, to our knowledge none of the empirical studies have dealt with a large multi-use center the size of the TCID in which efforts to create buffers to "hide" the commercial development are much more challenging and in which problems of traffic, noise, crime, and aesthetic pollution are more likely to be magnified.[6] Thus, we embarked upon our own original research specific to The Woodlands area and the impact area designated by the enabling legislation which should help fill the gap in the literature regarding the impact of today's common suburban phenomena of large, comprehensive commercial centers.

DATA AND METHODOLOGY

The objective of this study is to measure the potential property value impact of the Town Center Development District of The Woodlands on nearby residential areas; thereby providing additional insights regarding the effect of large size commercial development in producing significant externalities upon surrounding residential areas. The methodology utilized follows the economics literature by employing a rather traditional hedonic approach. Typical hedonic estimating equations are utilized to isolate any TCID impact using specifications common to this large literature.

Following the contemporary literature on hedonic estimation in housing markets, special attention was given to issues of correct functional form and of treating the possibility of spatial autocorrelation. For example, Box-Cox transformations were implemented for both dependent and independent variables to resolve any questions over alternative specifications. The semi-log form was found to be the best functional form for the data since the Box-Cox λ was insignificantly different from zero.

The data utilized were also checked for spatial autocorrelation and the *Moran I* index was found to be positive and statistically significant, indicating some positive spatial autocorrelation. However, spatial autocorrelation corrected regressions, as well as cluster corrected regressions, did not alter the standard errors and t-statistics significantly. This indicates that while spatial autocorrelation exists, it is most likely due to missing variable(s) whose exclusion apparently does not have a significant effect on the empirical results and the estimated relationship between home prices and distance to TCID.

The semi-log estimating equation for determining the relationship between home value and specific structural and locational characteristics of the home utilizes the following functional forms (depending on the definition of distance variable):

$$Log\ P_i = \beta_0 + \beta_1 * SF_i + \beta_2 * SF_i^2 + \beta_3 * Age_i + \beta_4 * Age_i^2 + \beta_5 * LOT_i + \beta_6 * BATH_i + \beta_8 * WOOD_i + \beta_7 * DIST_i + \beta_8 * DIST_i^2 + \varepsilon_i$$

or

$$Log\ P_i = \beta_0 + \beta_1 * SF_i + \beta_2 * SF_i^2 + \beta_3 * Age_i + \beta_4 * Age_i^2 + \beta_5 * LOT_i + \beta_6 * BATH_i + \beta_8 * WOOD_i + \alpha_1 * D_{1i} + \alpha_2 * D_{2i} + \alpha_3 * D_{3i} + \alpha_4 * D_{4i} + \alpha_5 * D_{5i} + \alpha_6 * D_{6i} + \alpha_7 * D_{7i} + \delta_i$$

where P_i is the value of the i^{th} home (appraisal value or sale price depending on the data set utilized); SF_i , $Age_{i,}$, LOT_i , $BATH_i$ are respectively the square footage of living area, age, lot size, and number of baths for the i^{th} home; $WOOD_i$ is a location dummy for home located in The Woodlands master-planned community[7]; $DIST_i$ is the distance of the i^{th} home to the centroid of the TCID; and D_i's are the dummy variables for distance bands around the TCID.[8]

Initially the geographic domain of the data collected extended approximately 4 miles from the centroid of the TCID as defined by GIS mapping routines in order to make sure that there were sufficient observations for "control areas" beyond the 2 mile range proscribed by the Texas legislature. Since the boundaries of the TCID extend on average a half mile from its center, properties designated as 0.5 miles from the TCID (its centroid) are virtually adjacent to the center's boundary.

There are two data sources available that can be utilized. The first is Multiple-Listing Service Data of market transactions which we label Data Set 1. The second is tax appraisal data from the Montgomery County Appraisal District (MCAD), labeled Data Set 2. Both data sets, however, utilize MCAD data because it contains all of the basic information on each home, some of which is not available in the MLS records. This data include information on political jurisdictions, neighborhood associations, and actual property plat maps with GIS coordinates. It is from the GIS coordinates that distances from the TCID were calculated.

Normally, sales data are preferred over tax appraisal data because they more accurately represent market outcomes. The problem is that the amount of sales data available provides insufficient degrees of freedom to adequately account for changes in small distances from the TCID. This also appears to be the case with many of the other studies cited which must rely on very small sales data samples. If the price/distance function is in anyway non-linear as some of the literature suggests, it will be nearly impossible to adequately describe price patterns statistically with small sample sizes.

While in many parts of the country the correlation between tax appraised values and actual sales values is quite low, in Texas county appraisal districts are regularly monitored to meet the state mandate that all appraisals are made at market values. In addition to the State's own ratio studies, the researchers at the Institute for Regional Forecasting of the University of Houston have conducted more sophisticated analyses of the correlation between sales values and tax district appraised values for a variety of markets throughout the state and have found the correlation quite high and more importantly spatially unbiased. Thus, despite our preference for sales data, because of the limited size of sales transactions and the fear that the spatial density of transactions might be inadequate for precise estimation of what was anticipated to be a complex non-linear relationship between distance to the TCID and home values,

TABLE 1

DESCRIPTIVE STATISTICS OF THE DATA SETS

Variables	Sales Price Data	Appraisal Value Data
House Value	**180,365**	**144,464**
	(121,475)	(94,821)
Square Footage	**2351.3**	**2,302.7**
	(892.2)	(804.1)
Age	**20.06**	**21.86**
	(9.30)	(8.80)
Lot Size	**11,802.2**	**11,204.5**
	(13,037.5)	(4,988.3)
Bathrooms	**2.21**	**2.90**
	(0.56)	(1.11)
Distance to TCID	**2.14**	**2.01**
	(0.64)	(0.58)
Woodlands Dummy	**0.75**	**0.70**
	(0.43)	(0.46)
D1	**0.182**	**0.021**
	(0.39)	(0.14)
D2	**0.219**	**0.044**
	(0.41)	(0.21)
D3	**0.293**	**0.053**
	(0.46)	(0.22)
D4	**0.221**	**0.099**
	(0.42)	(0.30)
D5	**0.085**	**0.230**
	(0.21)	(0.42)
D6	_____	**0.309**
		(0.46)
D7	_____	**0.243**
		(0.43)
Sample Size	**661**	**10,505**

Note: Standard errors are in parenthesis. Distance bands such as D1 or D2 imply different distances in Data Set 1 and Data Set 2. More information about the exact coverage of distance bands can be found in the text under "Data and Methodology" section.

county tax appraisal district data became our preferred data set. This was not done, however, without first empirically comparing sales prices and appraised values within The Woodlands housing market.[9] Nonetheless, this paper reports the empirical results using both data sets in estimating the equations above, recognizing the advantages and disadvantages of each.

The geographic domain of Data Set 1 extended 3.5 miles from the edge of the TCID in order to pick up sufficient "control area" observations.[10] On the other hand, because of the enormous amount of data contained in the appraisal data set, there was no need to extend the area of study as far in order to capture additional observations to minimize any degrees of freedom problem. Thus, the total area analyzed with the appraisal data extends out only 3 miles.[11]

Data Set 1 contains 661 sales data on single family homes sold during 2003 within the impact area of this study as well as the January 1, 2004 MCAD appraisal value for the same homes with the following averages: $180,365 in sale price; 2,351 square feet of living area; 2.21 baths, 11,802 square foot lot size; and 20.1 years old. The larger data set, Data Set 2, contains 10,505 MCAD appraisal values (from MCAD 2004) for the homes located within the impact area with the following averages: $144,464 in value; 2,303 square feet of living area; 2.90 baths, 11,204 square foot lot size; and 21.9 years old. Table 1 presents the comparison of data sets in detail. It is worth noting that the mean "distances" in both data sets are not significantly different (2.14 versus 2.11 respectively) and they have a similar range of values.

The square of "distance" was also included in the analysis, but in order to more precisely determine the pattern of residential values with respect to distance and to account for possible complex nonlinearities, distance dummy variables (D1 to D5 for the sales data and D1 to D7 for the appraisal data) were created. Because the dummies are defined differently in the two data sets, comparisons between the two different sets of empirical analyses should be done with some caution.[12] In essence, the number and geographic distribution of the observations in the sales data forced us to restrict the analysis to fewer, larger bands in order to have large enough sample sizes in each band. The larger appraisal data set allowed us to fine tune the bands much more narrowly to get a better sense of any turning points in what was anticipated to be a non-linear relationship. Furthermore, after the empirical analysis was complete using Data Set 1, we had a better idea of how to define the more narrowly defined bands in Data Set 2 to isolate key inflection points.

EMPIRICAL RESULTS

Tables 2 and 3 provide the semi-log regression results for Data Set 1 and Data Set 2 respectively. For each table the results of three alternative models are presented. The only differences are related to the specification of the distance relationship. Models 1 and 2 use a continuous distance variable in linear and quadratic forms. Model 3 uses dummy variables as distance measurements as previously described in order to capture potential irregular nonlinear patterns between distance and price. In general, the same geographic pattern in home values across distance is revealed. The price/value relationship is unambiguously non-linear, but as discussed below the estimated peak at which prices are their highest vary.

TABLE 2

OLS REGRESSION RESULTS FROM DATA SET 1 DEPENDENT VARIABLE: LOGARITHM OF SALES PRICE

Variables	Model 1	Model 2	Model 3
SF Squared	**-0.025**** (4.3)	**-0.024**** (4.5)	**-0.023**** (3.9)
Age	**-0.017**** (3.2)	**-0.026**** (4.4)	**-0.023**** (3.8)
Age Squared	**0.0001** (1.0)	**0.0003** (1.4)	**0.0002** (0.9)
Lot Size	**0.005**** (5.2)	**0.005**** (4.8)	**0.005**** (5.8)
Bathrooms	**0.112**** (4.5)	**0.107**** (4.9)	**0.114**** (5.7)
Distance	**-0.069**** (3.4)	**0.225*** (2.1)	_____
Distance Squared	_____	**-0.071**** (3.6)	_____
Woodlands	**0.099**** (3.0)	**0.101**** (3.2)	**0.080**** (2.7)
D1	_____	_____	**0.154**** (3.8)
D2	_____	_____	**0.224**** (4.5)
D3	_____	_____	**0.155**** (3.1)
D4	_____	_____	**0.108**** (2.5)
Constant	**10.993**** (156.4)	**10.809**** (98.5)	**10.773**** (247.6)
Adj. R-squared	**0.765**	**0.768**	**0.767**
Sample Size	**661**	**661**	**661**

Note: Absolute value of t-statistics are in parenthesis. ** Significant at 1% level, * Significant at 5% level.

The adjusted R-squares reported in Table 2 are smaller for all the models than those in Table 3 largely because of the smaller number of observations (and hence degrees of freedom) in the smaller sales data set. Nonetheless, the 77% R-squares reported are still quite respectable for this type of hedonic analysis. For all cases in both tables, the coefficients of housing characteristics are as expected and have relatively high t-statistics. In both runs of model 1 the coefficient of the distance variable is negative and strongly significant. The small differences between the results of the two tables are not statistically significant. The negative sign of the coefficient in this linear specification suggests that on net prices tend to rise with proximity to the TCID, not fall, a finding that appears to contradict the notion that commercial developments produce at least some degree of negative externalities upon nearby residential areas.

Models 2 and 3, however, show that the general upward trend in home prices with respect to proximity is not monotonic. Applied to both data sets these models indicate that while prices in general rise as homes get closer to the TCID, there is a point in which they begin to fall back down. However, despite this decline, prices never retreat below the level of prices in the more distance control areas.

Unfortunately, the exact inflection point is much more difficult to ascertain and the results for models 2 and 3 as reported in both tables provide somewhat different estimates of the point at which prices peak and the height of that peak. For example, the distance coefficients of the quadratic equation in Table 2 suggest that prices peak at mile 1.58 before starting to fall back down. The results of the same specification using Data Set 2 as reported in Table 3 indicate that the peak occurs at mile 0.87. This difference is not particularly surprising since fitting a quadratic to a relationship which is non-linear but irregular often produces such a divergence.

To better accommodate what are likely irregular non-linearities, model 3 uses a series of distance dummy variables in an effort to better determine the actual pattern of prices. The results, however, are quite similar. Indeed, model 3 results suggest that the relationship between distance and price is parabolic. While the empirical results for both data sets tell essentially the same story, the results displayed in Table 3 are more useful because the larger number of observations allowed for narrower distance bands. Those results shown under model 3 in Table 3 suggest that the home values increase with the proximity to the TCID until some point between 1.50 and 1.25 miles. Beyond that point, as properties get closer to the TCID values start to fall.

These results are somewhat consistent with the conclusions of Li and Brown (1980) and Colwell, Gujral and Coley (1985) regarding the counter balancing effects of both positive and negative effects associated with nearby commercial establishments and may help to explain why some researchers such as Song and Knapp (2004) find little or no pecuniary effect upon nearby housing markets. The difference here is that the analysis is not related to small neighborhood commercial shopping sites, but a large regional mall with a significant amount of non-retail activity as well. Clearly the types of potential externalities suggested in the literature such as noise and light pollution, traffic congestion, and aesthetic deterioration would have been expected to be much greater for an area such as the TCID. Apparently, while such negative externalities may be more severe for larger centers, their beneficial effects, such as employment and accessibility to convenient one stop shopping, are also larger, negating much if not all of those negative impacts.

The one expectation in the literature that this research seems to bear out is that the negative externalities of larger commercial centers appear to extend further than for the small centers which the literature has typically treated before. Instead of the <u>net</u> negative impact extending a few hundred feet, the impact appears to influence prices anywhere from about a half mile to as far as 1.5 miles from the boundaries of the TCID (1 to 2 miles from the TCID's center). Given the size of the shopping center and the amount of traffic generated by the large amount of office space in the area, this is not particularly surprising.

TABLE 3
OLS REGRESSION RESULTS FROM DATA SET 2
DEPENDENT VARIABLE: LOGARITHM OF APPRAISAL VALUE

Variables	**Model 1**	**Model 2**	**Model 3**
SF Squared	**-0.022****	**-0.021****	**-0.023****
	(11.5)	(10.9)	(12.1)
Age	**-0.017****	**-0.019****	**-0.018****
	(18.4)	(19.0)	(16.8)
Age Squared	**0.00006***	**0.0001****	**0.0001****
	(2.0)	(4.7)	(5.3)
Lot Size	**0.004****	**0.004****	**0.004****
	(4.6)	(3.9)	(4.0)
Bathrooms	**0.059****	**0.057****	**0.059****
	(19.5)	(18.4)	(19.2)
Distance	**-0.078****	**0.068****	_____
	(25.2)	(3.1)	
Distance Squared	_____	**-0.039****	_____
		(6.5)	
Woodlands	**0.153****	**0.144****	**0.147****
	(2.6)	(2.4)	(2.9)
D1	_____	_____	**0.080****
			(6.0)
D2	_____	_____	**0.129****
			(68.5)
D3	_____	_____	**0.157****
			(18.7)
D4	_____	_____	**0.116****
			(26.5)
D5	_____	_____	**0.076****
			(11.8)
D6	_____	_____	**0.063****
			(12.3)
Constant	**10.907****	**10.831****	**10.684****
	(256.4)	(224.5)	(286.9)
Adj. R-squared	**0.871**	**0.872**	**0.872**
Sample Size	**10,505**	**10,505**	**10,505**

Note: Absolute value of t-statistics are in parenthesis. ** Significant at 1% level, Significant at 5% level.

Nonetheless, the estimated point in space where prices peak are somewhat different when using the alternative data sets. In general, the regression analyses using the smaller sales price data indicate that prices peak further away from the TCID than the same analyses using appraisal values. In Table 3, prices peak in model 2 at mile 0.9 and in model 3 between mile 1.00 and mile 1.25. In Table 2, model 2 indicates that prices peak at mile 1.6 and in model 3 they peak between mile 1.5 and 2.0. One explanation for this divergence is that the number of observations scattered across distance is much sparser for the sales data set which might make it more difficult to precisely define the price function's turning point. Another explanation is that the county appraisal district, applying rather standard appraisal practices, was forced to pick comparables that were more or less distant from the TCID and hence did not adequately pick up the subtleties of small changes in distance to the TCID.

Interestingly, the values of homes within the closest distance band from the TCID are still higher than in the control areas. This is true for both data sets, as reported in Tables 2 and 3, though properties with very close proximity are found to have a larger "net" premium using Data Set 1.[13] Data Set 1 also produces the greatest reversal in prices, falling with proximity a full 7% off their peak. In either case, the results confirm that, independent of the positive spillover effects, close proximity to the TCID does bring with it substantial negative externalities. What this means about the relationship of distance and negative spillover effects is ambiguous, however, because the net decline in prices which begin somewhere between 1 and 2 miles may be as much a function of diminishing marginal benefits of being slightly closer to the TCID as it is increasing marginal negative external effects associated with proximity.

From a policy perspective, these results indicate that no home values within any reasonable definition of the "impact area" have experienced a net negative impact due to spillover effects from the TCID. To the contrary values appear to be higher because of its presence. Everywhere, prices within the 3 mile radius of the TCID are higher than beyond that range, including prices of homes adjacent to the TCID's boundary. This should ameliorate much of the concern by the Texas legislature that their chartering of commercial self-taxing districts within the state's metropolitan areas might be a serious detriment to close-by residential areas. This does not mean, however, that there are not social gains to attempts to minimize the negative external effects that do appear to be present. Social welfare maximization would require efforts to maximize the benefits emanating from the large commercial development while at the same time encouraging measures to reduce the negative impacts they are likely to produce.

From a research perspective, while these findings are in harmony with the findings of Li and Brown (1980), and Colwell, Gujral and Coley (1985), who suggest that the positive effects associated with commercial development for most surrounding neighborhoods outweigh any negative effects. We now have a sense for the first time that such a conclusion is applicable to the large mega commercial centers which have become popular in American suburbia, but which stand out as islands of clearly non-conforming land uses.

CONCLUSIONS

Given the long history of concerns over potential negative externalities associated with close proximity to non-conforming land uses, it is not surprising that the Texas State Legislature includes provisions in enabling legislation for commercial self-taxing districts which mandate that a portion of revenues collected by these districts be used to ameliorate any of these possible negative effects. To a limited extent empirical academic studies have been able to document pecuniary impacts of these purported commercial land use externalities. Unfortunately, the literature provides little guidance regarding the degree or the extent of the geographic distribution of these negative spillover effects, information needed to base policies upon some rational criteria.

The existent literature reviewed here suggests that, at most, any negative impacts that are likely to occur from commercial developments are limited to areas of very close proximity. Supporting this finding are studies that suggest commercial development might generate both positive and negative amenities, and that it is only in residential areas adjacent or near to commercial development where the negative impacts outweigh the positive.

However, the typical commercial development analyzed in the literature is relatively small, often of the neighborhood shopping center size. One question that remains is whether impacts would be substantially different for large multi-use commercial developments that are the usual candidates for placement in self-taxing districts. One might easily expect that for large developments, the extent and spatial penetration of negative spillover effects, such as noise, light, traffic, and aesthetic diminution, would be much greater.

The results of this research both support and supplement the existent literature. They add support to the findings that proximity to commercial land uses creates both positive and negative impacts upon nearby residential areas. The results here suggest, however, that negative spillover effects for larger commercial centers extend further out than reported in past studies, since the pattern found here shows that prices on net continue to rise with distance from the TCID for around a mile beyond TCID's boundaries. Still, one interesting finding is that, despite the enormous size of the TCID, the negative effects, even at its border, are outweighed considerably by the positive effects. This may explain the recent interest of developers in building residential units right within the district.

Given that no residential area within the "impact area" is suffering from any "net" negative spillover effect, one must question the need for mitigation funds. Certainly, in terms of equity and the distribution of wealth, nearby households are better off with such commercial development than without. However, from an efficiency perspective, the evidence presented here that negative spillover effects do exist, suggests that there are potentially additional welfare gains to be made associated with these commercial developments, if the negative externalities could be ameliorated. Thus, policy makers would do well to focus mandated expenditures by commercial districts to minimize any spillover effects upon very close residential properties as opposed to requiring a mere transfer of funds to these communities to "compensate" them for losses that are in fact not occurring.

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ENDNOTES

1. Jud (1980) is one of many who provide an economic defense of such public sector intervention through zoning and/or private sector “extra-market mechanisms”, such as restrictive covenants.
2. See Ohls, Weisber, and White (1974), Stull (1975), Muth and Wetzler (1976), Jud(1980) and Ihlandfeldt (2007).
3. Some districts also occur within municipalities to effectively guarantee that a portion of the tax revenues generated by the district is automatically reinvested into the district itself.
4. The radius of the TCID is more than three quarters of a mile, so the impact area suggested by the legislature is almost 3 miles from the TCID’s center.
5. See Li and Brown (1980), Grether and Mieszkowski (1980), Colwell, Surinder and Coley (1985), and Thibodeau (1990).
6. On the other hand, the secluded and well hidden nature of this commercial enclave that fits so well within the natural surroundings of the area suggests that the TCID might affect surrounding areas in a significantly different way than the typical commercial land use analyzed in the literature.
7. In general there exists a premium in the Greater Houston housing market for homes located in master planned communities. Since The Woodlands is Houston’s premier master planned community and since some of the “control areas” are located outside the boundaries of The Woodlands, it was deemed appropriate to distinguish between properties within and without The Woodlands.

8. Distance bands were created to better capture the shape of the price function with respect to distance. Both data sets utilized produce a similar shape for the price function, confirming that the relationship is not monotonic.
9. Empirical analyses of the two data sets indicate that the problems of using appraisal data instead of actual sales data are not likely to be serious. For the 661 actual sales data obtained, their companion MCAD appraised values were also available. Using those observations, the ratio of the logs of appraisal values to sales prices were regressed on housing characteristics and distance to TCID producing a very low R-squared ($R^2 = 0.0069$), F-statistic ($F = 0.38$), and t-statistics on all of the explanatory variables (all the t-statistics are below 1 in absolute terms). While other specifications indicate somewhat higher R-squares; in general, the results indicate there is very little systematic pattern in appraisal value measurement error across relevant variables of interest.
10. We wished to limit the size of the control area, however, to minimize any need to have to control for other factors within the housing market that might be influencing values.
11. This change was totally consistent with the analysis of the sales data in that no impact was found beyond 3 miles.
12. For Data Set 1 the distance dummy variables are defined in terms of miles as follows: D1 < 1.5; 1.5 < D2 < 2.0; 2.0 < D3 < 2.5; 2.5 < D4 < 3.0; D5 > 3.0. For Data Set 2 they are defined as: D1 < .75; .75 < D2 < 1.0; 1.0 < D3 < 1.25; 1.25 < D4 < 1.5; 1.5 < D5 < 2.0; 2.0 < D6 < 2.5; D7 > 2.5.
13. While prices within the closest range in Table 2 are higher than prices in the closest range in Table 3, this is not necessarily contradictory, since both the ranges and the control distance are different in the two empirical exercises.