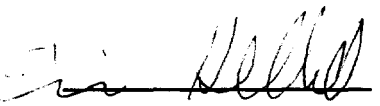
THE SECURITY OF LAND VALUES UNDER ZONING:
An Empirical Analysis of Baytown and Pasadena, Texas

An Honors Thesis (HONRS 499)

by

Jeremy R. Groves

Thesis Advisor
Dr. Eric Helland



Ball State University
Muncie, Indiana

April, 1998

Expected Graduation

May, 1998

Data collection funded by the Undergraduate Research Grant sponsored by Ball State University's Department of Academic Affairs, Office of Academic Research and Sponsored Programs.

Abstract

In 1916, New York City passed the first zoning ordinance in any city in the United States. That ordinance was soon modeled and passed by all but a very few of the cities in the country. One of the primary promises made by the supporters of zoning is that zoning increases the values of the residential land in the city. This is accomplished by assuring that a commercial or industrial use is not constructed adjacent to the residential use causing a nuisance situation. Because almost every city in the country passed their zoning ordinance before the 1930's, finding the data necessary to support the claims of zoning supporters has been nearly impossible. This paper tests the hypothesis that zoning increases residential land values estimating the impact of a resent ordinance on the sale values of homes. In 1995, the city of Baytown, Texas, passed its first zoning ordinance producing a natural experiment on the effects of zoning. Previous studies conducted by McMillen and McDonald (1993, 1998) have found that there is a differential impact of zoning on residential land values dependent on the pre-zoning distribution of land use and the viability of a given use. Simply, residential zoning has a different impact on land that is more suited for commercial use than land more suited for residential use. This study uses a Condition, Desirability, and Utility Index that was included in the data set as a proxy for measuring the suitability of the land for residential use. The findings of this study support the model put forth by McMillen and McDonald and, more specifically, find that zoning has an impact on land values that is determined differently based on the suitability of the land as measured by the CDU index.

I. Introduction

In 1916, in response to the increase of nuisances cases resulting from the growing garment industry, New York City instituted the first zoning ordinance in America (Mandelker, 1995). Shortly thereafter, all but five of the then forty-eight states had passed enabling acts that allowed their municipalities to enact zoning ordinances (Mandelker, 1995). Over the past eighty years, the zoning ordinance has grown from regulating size, density, and use to regulating sign usage, parking, and various other development issues. Zoning's popularity can be explained largely by the belief that it secures, or even increases, the value of the land that it regulates (Smith, 1965). This theory is logical because zoning does decrease the probability of the construction of a negative eternality producing use on an adjacent site to a residential use, thus depressing the value of the residential land.[1] This security from the possibility of future externalities should increase the value of the land by decreasing the risk of future land value being depressed causing a loss on investments. Testing zoning's impact on land values on an empirical level has been a very difficult task to accomplish.[2] The reason for the limited number of empirical tests is due to the lack of data from which to develop an adequate test because almost all of the major cities enacted zoning in the early part of the century.

The goal of this paper is to test the impact of zoning on land values using more recent data. The hypothesis that the introduction of a zoning ordinance increases land values (Smith, 1965) is tested against the null hypothesis that zoning has no effect. This study also tests the hypothesis that the pre-zoning suitability for residential uses[3] causes differing impacts of zoning on the value of the land versus the hypothesis that the pre-zoning suitability does not matter. This study contributes to the literature by testing a data set that is dated from 1988-1997 and encompasses the passage of an original zoning ordinance. The data originated from the cities of Baytown and Pasadena, Texas, surrounding the period when Baytown passed its first zoning ordinance[4] and includes Pasadena, which has no zoning ordinance to enforce land use restrictions or limit nuisance cases. The data set reports the sale values for homes in both cities over a nine year period that includes house level observations from both the pre-zoning and post-zoning time periods. The data also include additional information that can be used to develop a hedonic price model in order to control for other factors that may impact the sale price of a home and to

[1] Because of variances, which allow for specific case changes and wavers in the zoning ordinance and are required in order for zoning to be constitutional, zoning does not eliminate the all possibilities of negative externality producing land uses from being constructed near residential uses.

[2] The one of the few empirical test of zoning's effect is conducted by McMillen and McDonald (1993). Their study evaluated historical data from the city of Chicago in the 1920's.

[3] As measured by the CDU Index explained later in this paper.

[4] July 1995.

ascertain the impact on zoning on the value of the land. The results of this paper support the conclusions of McMillen and McDonald (1993, 1998) that zoning does not have an overall impact on land values, but that zoning has a differential effects caused by the pre-existing suitability.

The second section of this paper reviews the existing literature, among which there is little agreement about zoning's effect. Section three reviews the data and the models that are used in this study while section four reviews the results when that data is analyzed. The paper is concluded by summarizing the process and touching on the implications of the analysis of this data.

II. Theory

Although there are several studies that have examined the effects of zoning, few of them are consistent in their conclusions about the effects. One reason for these inconsistent results is the method used to test zoning's impact. Specifically, the effects of zoning are usually tested in cities already zoned. This makes it difficult, if not impossible, to accurately approximate the direct affect of zoning on housing values because there is no *pre-zoning* data. The existing literature and criticism of that literature, however, can be very valuable in setting up the model for this analysis.

The classical article addressing the issue of zoning is by Ohls, et. al. (1974) in which externality and fiscal zoning are studied. In this article the authors look at the effects of zoning if it is created in response to externalities produced by incapable uses or if zoning is being created in response to political pressures. Using a theoretical model, Ohls, et. al., show that zoning does increase the utility of land owners (i.e. raises their land value) by reducing the externalities that affect the land owner. The article also brings into question the idea of whether or not all externalities are negative. Ohls, et. al., ask the question about those uses that are banded by zoning that cause positive externalities and state that the above mentioned increase in utility can be offset by the increase in resources needed and higher transportation costs due to zoning. If we do not consider the positive eternality case, then this study supports the premise that zoning increases the utility of land owners, thus leads to higher housing values. This link is supported by Smith (1965) in his book Citizen's Guide to Zoning that claims zoning determines the investment of a homeowner into her home. The Ohls, et. al. paper concludes by stating that no answer to the effect of zoning in general can be found, but that fiscal zoning, which is zoning based on a political agenda, can depress land values. Subsequent articles view zoning as a pre-existing condition and attempt to show that zoning increases the value of the land just as it increases the utility of the land owner.

Another way to look at the question of zoning is addressed by a Grieson and White (1981) article who looks at how different zoning methods affect the value of the land it regulates. The authors examine

the methods of use restrictions, density restrictions, and minimum input requirements individually. Although they find that the method of zoning used affects the land values, they use theory to determine the outcome of each method independently. The authors point out a limitation of this approach, namely that these three methods of zoning are often used in conjunction as part of a larger, more complicated zoning ordinance. This limitations and the lack of empirical support draws into question Grieson and White's primary conclusion. It should be noted however, that the article does bring to surface an important issue when studying the effect of zoning, specifically the method of zoning ordinance used. Today there are various types of zoning ordinances such as Euclidean zoning and performance based zoning. This paper studies the effects of Euclidean zoning, which is the more popular zoning method used by cities.

Pollakowski and Wachter (1990) look at the question of zoning on a competitive bases between municipalities in the same county. Using data from Montgomery County in Maryland, Pollakowski and Wachter generate a housing price index to find the effect of zoning on, not only the zoned area, but also the surrounding areas. The article concludes that zoning does increase the land values of the land it regulates and the surrounding areas. The authors, however, point out that this could be caused by the monopoly effect created by more restrictive zoning ordinances, which also explains the increase in values in the surrounding areas. The study is limited by the fact that the data is collected under a system in which zoning is pre-existing and therefore does not allow for a study of the direct effect of zoning as a new institution. By using this approach, zoning is already a part of the expectations of the residents of the community and therefore they expect the probability of a negative externality being built next to them to be low already and this expectation is already in the value of the home.

McMillen and McDonald (1993) test the impact of zoning using data from the city of Chicago using both pre- and post-zoning data. The authors address the theory that the introduction of a zoning ordinance in Chicago should have caused the land value in 1923 to increase. The article uses pre-zoning data on the block level and compares it to post-zoning data at the same level and concludes that zoning did not increase land values in Chicago after it was adopted. They also conclude that "zoning decisions were influenced by both relative land values and past land use." This argument is furthered in a more recent study by McMillen and McDonald (1998) that develops a model of when zoning should be used and, based on the preexisting conditions, what is expected if zoning was implemented.[5] The model, shown graphically in Figure I, is a linear model that measures the value of land versus the percentage of the land that is residential. The model predicts that different pre-zoning land use structures yield

[5] See Figure I.

different results in effect zoning has on land values.[6] Their model predicts that if zoning occurs and the land value curve is similar to R 1, then no impact is seen because zoning is only following the market. If the land value curve is similar to R 2, then the land value appears to increase from A 2 to A 2* when zoning is enacted, however, this is only an efficient situation if the commercial curve is lower than the residential curve. A third option is that the land fits a curve such as R 4 that is negatively sloping. If residential zoning is passed in this case, the land values fall from A 2 to A 4* causing zoning to have a negative effect on housing values. Just as in the McMillen and McDonald articles, this paper looks at a pre- and post-zoning condition. If McMillen and McDonald are correct in their conclusions, this paper should also find an effect from the zoning ordinance on the value of the housing stock in Baytown that is based on the preexisting land distribution.

The first hypothesis being tested is that a simple zoning (including use, density, and input restrictions) has a positive effect on the housing values of the land (either positive or negative). The underlying assumption of this test is that zoning protects the value of the land it regulates (Ohls, et. al., 1974; Pogodzinski and Sass, 1991; Smith, 1965), and thus leads to an increase in the investment into that land that is signaled by an increase in the sale value of the home located on the zoned land. This is based on the idea that in an unregulated market, certain uses depress the land value of residential properties, which leads to a decrease in investment into the property by means of investing in the home (Pogodzinski and Sass, 1991). Also, McMillen and McDonald (1998) find in their model that residential values are the values most likely to change since, under most zoning ordinances commercially, zoned land can include residential uses. For these reasons, only residential uses are studied in this analysis.

The second hypothesis to be tested is that the preexisting suitability of the land for residential use has a differing effect when zoning is passed according to the preexisting suitability. In other words, does zoning have a different effect on different areas of residential land. This is based on the McMillen and McDonald (1998) model that stated that different land use suitabilities cause zoning's effect to be different. To measure the use suitability, a Condition, Desirability, and Utility Index that is included in the data set is used.[7]

III. Data

The data set used in this paper is compiled from the County Appraiser's District of Harris County, Texas, and that office's Sale Books. These Sales Books include all housing transactions that have occurred since 1988 through the time the sample was created.[8] The data set also includes the date

[6] This point was missed by the classic zoning ordinance as a solution for the non-convexities argument.
[7] This index will be explained in the following section of this paper.
[8] Approximately July 1997.

of sale, the validity of the sale value, the transaction amount, the amount of land involved in the sale, the value of the land, the number of stories, the year the home was built, the construction grade of the home, a Condition, Desirability and Utility (CDU) category, total square footage of living space, and the existence and value of any amenities. The data set includes approximately 4,331 usable observations and spans a period of 9 years and includes transactions from both Baytown and Pasadena, Texas.[9] All of the sales figures have been translated into real 1988 dollar values.

The cities of Baytown and Pasadena have been chosen due to their proximity to each other and their location in Harris County. Prior to constructing the tests used in this paper, these two cities were analyzed by using the 1990 Census and were found to have similar characteristics such as income and size. These characteristics can be seen in Table I. An important difference between the two cities is that Baytown is headquarters for some heavy industrial sites such as Ashland Chemical, Exxon Chemical, Advanced Aeronatics, and Stauffer Chemicals. Baytown is selected for this study because of its recent passage of a zoning ordinance; the first zoning ordinance passed into law in Harris County. Given the number of externality producing land uses in Baytown, one expects the zoning ordinance to have some impact on the land values if the theory of zoning's impact is correct. If zoning does prove to have an impact of any sort on the values of residential homes, then there is no need for a measure of the extent of the externalities produced by the industrial sites. If, however, zoning does not have an impact on the residential home values, then a measure of the externalities produced by these industrial sites is necessary to determine if the externalities are large enough to need zoning to protect the land owners from these externalities. Pasadena was chosen because of its lack of zoning. The descriptive statistics for both Baytown and Pasadena before and after zoning can be found in Table II. We find that we can not reject the null that the means of the sale value for homes in each city is equal before and after the zoning ordinance.[10] The statistics also show that there is a statistically significant difference between the means of the two cities both before and after zoning is passed in Baytown.[11] This difference, however, is controlled for by adding a variable for homes in Baytown into the regression models being used in the study.

Variables Used

The Sales Book data set contains several factors that may determine the selling price for a home. To control for these factors this study estimates a hedonic price model (Berndt, 1991). This means that the model used for the regressions have housing characteristics as independent variables acting on the

[9] Some of the original observations were discarded due to incomplete information.
[10] The approximate p-Value for Pasadena and Baytown difference of means test is .1230 and .3192 respectively.
[11] Both p-Values are .0000.

dependent variable of the house value. Table III lists all of the variables used and their expected signs, means, standard deviations, and minimum and maximum values. The first variable is the *Transaction Amount Per Thousand* that is the dependent variable in this study and gives the selling price for the home.[12] *Age*, the second variable, is created by subtracting the year the home was built from the year the data was obtained (1997) and this coefficient is expected to be negative meaning that as the house gets older, it sells for a lower price. The amount of living space in the home being sold is denoted by *Living Square Footage* and is expected to have a positive coefficient meaning that increases in the size of living space increases selling price. The *Number of Stories* variable measures the height of the home in stories and is expected to have a positive effect on the dependent variable because more stories usually implies more space in a home. *Carport*, *Garage*, and *Pool* are each dummy variables that equal 1 if a carport, garage, or pool, respectively, is included in the sale of the home. It is expected that each of these variables have a positive effect on the transaction value.

The data set also included a Condition, Desirability, and Utility Index (CDU) that rates the location of the home based on the condition and other location factors (i.e., proximity to a busy street or any other externalities affecting the property). This index is divided into six categories of very good, good, average, fair, poor, and very poor and are in hierarchical order. These are represented by dummy variables which equal 1 if the home is in that respective category. The categories are mutually exclusive of each other meaning that a home must fall into one, and only one, of the categories.[13] It is expected that *CDU Very Good* and *CDU Good* both have positive signs showing that by being in these categories the value of the homes increase. It is unclear what sign the *CDU Average* and *CDU Fair* variables are since they are in the middle of the hierarchy and are the inflection points of the values magnitudes. The *CDU Poor* and *CDU Very Poor* variables are expected to have negative signs that causes a decrease in the value of the homes classified in these categories. The most important aspect of these CDU values is the relative size of the coefficients. We should expect a hierarchic of size ranging from *CDU Very Good* to *CDU Poor*. The reasoning for these expectation is that these categories provide information about the surrounding environment of these homes. A CDU index is assigned by the appraiser based on a point system that gains bonuses for desirable aspects, such as lake front property or a clean neighborhood, and negative points for aspects that take away from the desirability of the site such as being next to a busy road or near externality producing uses. As the CDU level decreases for residential lands, it is expected that a similar variable for commercial uses increases since some of the criteria for low CDU's in residential land, such as close to major highway, are positive factors for commercial uses. Based on this,

[12] The amount is given in thousands in order to reduce the relative magnitude of the coefficients and standard errors.

the CDU acts as a proxy for the suitability of the land for residential use. The two variables created based on the data set are *Zoning* and *Baytown*. Each of these are dummy variables whose value is equal to 1 if the home was sold under the zoning ordinance[14] or located in the city of Baytown respectively.

The Models

The first hypothesis being tested by this paper is that zoning variable has a positive impact on the value of a home being sold after the passage of the zoning ordinance. In order to test this we use the following hedonic price model:

$$Transaction\_Amount\_Per\_Thousand = \beta_0 + \beta_1 Zoning + \beta_2 Baytown + \beta_3 Age\_of\_House + \beta_4 Living\_Square\_Footage + \beta_7 Number\_of\_Stories + \beta_8 Carport + \beta_9 Garage + \beta_{10} Pool + \beta_{11} CDU\_Very\_Good + \beta_{12} CDU\_Good + \beta_{13} CDU\_Average + \beta_{14} CDU\_Fair + \beta_{15} CDU\_Poor$$

The second hypothesis being tested by this paper is the effect of when zoning is interacted with the CDU index. In other words, what is the different effects on the selling value that zoning causes based on the preexisting suitability for residential use as measured by the CDU index. This hypothesis is tested with the following model:

$$Transaction\_Amount\_Per\_Thousand = \beta_0 + \beta_1 Baytown + \beta_2 Age\_of\_House + \beta_3 Living\_Square\_Footage + \beta_4 Number\_of\_Stories + \beta_5 Carport + \beta_6 Garage + \beta_7 Pool + \beta_8 CDU\_Very\_Good\,/\,Good + \beta_9 CDU\_Average + \beta_{10} CDU\_Fair + \beta_{11} CDU\_Poor + \beta_{12} Zonging * CDU\_Very\_Good\&Good + \beta_{13} Zoning * CDU\_Average + \beta_{14} Zoning * CDU\_Fair + \beta_{15} Zoning * CDU\_Poor$$

where the variables are as describe above and the variable *CDU Very Good/Good* is a combination of the *CDU Very Good* and *CDU Good* variables and, *Zoning*CDU Very Good/Good, Zoning*CDU Average, Zoning*CDU Fair, and Zoning*CDU Poor* are dummies that are created by multiplying the *Zoning* variable with the respective CDU variables and equal 1 when *Zoning* and the respective *CDU* variable both equal one. Both model are ran with White's Hetorskedasticity Corrected Standard Error (Kennedy, 1992) test in order to correct for the hetorskedasticity of the data due to this being a cross-section study.

IV. Results

Hypothesis One (Zoning)

The results from the first regression can be found in Table IV. We see that the Baytown variable is significant and that it causes a $1,793.26 increase in the selling price of a home. This is consistent with the difference of means test that shows a difference between the selling price of home in Baytown

[13] The *CDU Very Poor* variable will be excluded from the test to avoid collinearity with the intercept.

and Pasadena. Next we see that the *Age of House* variable has the expected negative sign showing a decreases the dependent variable by about $7,834.85 as the age of the home increases by one standard deviation of age.[15] In addition, the *Living Square Footage* is significant, the sign is positive and a one standard deviation increase increases the dependent variable $4,618.00. As the number of stories increases by one standard deviation, the price of the home increases by approximately $1,852.90, which follows expectations that a larger house demands a higher selling price. The existence of a carport decreases the value of the home by approximately $1,857.00, which is expected since carports are imperfect substitutes for garages. A garage was found to increase the value of home by approximately $2,601.32 while a pool increases the value of home by approximately $18,700.00. This meets expectations since both a garage and a pool requires a great deal of capital investments in both money and land. The *CDU Very Good* and *CDU Good* variables follow our expectations in that they are positive and their magnitude decreases respectively from an increase in value of $37,900 for a home in the very good category to $23,700 for a good CDU categorization. The CDU category of average is also significant and increases the value of the home by about $7,100.00.

The *Zoning* variable is insignificant in the analysis. This is consistent with the findings of McMillen and McDonald (1993) who concluded that it could not be stated that zoning increased the value of homes in Chicago.

Hypothesis Two (Interacting Zoning with CDU Index)

When the zoning variable is interacted with the CDU variables we find that there is in fact an effect by zoning that does depend on the pre-zoning classification of the land. The results from the first test of the second hypothesis can be found in Table V. The first variable to examine is the *Baytown* coefficient whose sign follows expectations in that it is positive and the coefficient shows an approximate $2,857.60 increase in the value of a home if it is located in Baytown. This is expected given that the difference of means test performed on the data found in Table II showed that the mean value of a home was not equal between the two cities and that the Z value of the test was negative showing that Baytown's mean was higher. The *Age of House* variable also gives the expected result in that it is negative and one standard deviation change subtracts $7,715.77 from the value of the home indicating the intuition that homes depreciate. The *Living Square Footage* variable is also consistent with exceptions by being positive with a $4,523.47 impact on the transaction value with a one standard deviation increase. The *Number of Stories* variable is also positive and increases the home selling price by $1,860.36 when the number of stories increases by one standard deviation. The *Carport*, *Garage*, and

[14] Corresponding to after July 1995.

Pool variables are negative, positive, and positive respectively. The *Carport* variable shows that if a home has a carport, the value of the home decrease by about $1,751.00. Again, this is due to carports being imperfect substitutes for garages. Having a garage or pool increases the value of the home by about $2,927.00 and $19,000.00 respectively and these values are consistent with expectations that both a garage and a pool adds a much higher value to a home due to the space required and the high capital investment involved with the construction of each. Next we see that the *CDU Very Good/Good* and *CDU Average* are both positive and their magnitudes decrease according to their hierarchical order. In other words, a home indexed as *CDU Very Good/Good* adds about $22,162.00 to the value of the home whereas if it is indexed as *CDU Average* it increases of about $14,061.00 the selling price of a home.

Finally we look at the interaction variables that show the interaction of *Zoning* and the CDU index. These variables are all significant by at least the .05 level and show a decreasing effect on the value of the home with a change in sign occurring at the *Zoning/CDU Average* variable and continuing with the negative sign thereafter. The impact of the variables on the home values are (in order from *Zoning/CDU Very Good/Good* to *Zoning/CDU Poor*): $11,310.00, -$3,147.00, -$3,921.00, and -$7,738.00. These results allow us to reject the null hypothesis that the variables are zero and concluded that the CDU index that the home is categorized has an impact on the value of the home.

These findings support the conclusions of McMillen and McDonald (1998) that predicts that if a land area is more suited for commercial use, then a zoning ordinance that classifies the area as residential depresses the land values. Figure I is the graphical representation of the McMillen and McDonald theory. On this graph, the non-zoning market proportion of residential use is denoted by P* on the horizontal axis with the land value per acre denoted on the vertical axis. An area of land that is suited for residential use is denoted by the R 1 curve and has an after zoning land value of A 1. This corresponds to the CDU indexes of either Very Good or Good. This paper finds that the *CDU Very Good/Good* variable shows an increase in land value due to the passage of the zoning ordinance which supports the prediction of the McMillen and McDonald model. In the McMillen and McDonald model, the R 2 and R 3 curves are land area that not necessarily suitable for residential use as per the C curve that denotes the suitability and land value per acre of commercial uses with respect to the proportion of residential land use. With these curves, if the ordinance zones areas of land fitting curves R 2 and R 3 given the C curve, the land value increases, but it is not efficient because under the market condition, the use of this land as commercial brings a higher values per acre. This prediction leads one to believe that the remaining CDU's follow these cases, however the signs of the CDU variable become negative after the *CDU Very*

[15] See Table III for all standard deviations.

Good/Good. This leads us to examine the final case predicted by McMillen and McDonald (1998) model. To observe this case, we have added the negatively sloped R 4 curve.[16] Land areas represented by this curve see a negative impact on the land value when zoned residential as their value falls to A 4*. This is due to the fact that the higher proportion of the land that is residential, the lower the value of the land and since zoning forces the land to be exclusively residential. This paper supports this case with the *CDU Average*, *CDU Fair*, and *CDU Poor* variables representing land areas that are represented by the R 4 curve. The findings of the regression support the predicted results of the McMillen and McDonald model.

V. Conclusion

When Baytown passed their ordinance they created a natural experiment of the effects of zoning. By utilizing this new data source, this paper has addressed the question of zoning's impact on the value of homes and asks the question of whether zoning truly does secure the value of the land that it regulates.

This study finds that, although we cannot reject the null hypothesis that zoning has no overall effect on the values of homes, we do see that zoning has a differential impact on the value of residential land. This study shows that zoning's effect when looked at as a whole is washed out by the differing effects based on the suitability of the land. When land that is suited for residential use is zoned residential, there is an increase in the land value. When land that is zoned residential that is not suited for large residential use, as represented by the R 4 curve, there is a decrease in the land value. The suitability for residential use is measured by the CDU index in this study. The CDU index measure such characteristics such as closeness to busy roadways and other factors that makes an area less desirable for residential use but more desirable for commercial use. This study finds that the areas corresponding to the *CDU Very Good/Good* variable are suited for residential use and see an increase in the value of the land when zoned residential. Those areas categorized as average, fair, or poor are poorly suited for residential land uses and by zoning the land residential, the proportion of the land under residential use approaches 1.00 causing the value of the land to decreases.

In one respect the theory that zoning increases the value of land is true when the land being studied is suited for residential use. If the land, however, is not very suitable for residential land and is zoned residential, then the value goes down. This implies further that zoning disrupts the market by forcing all of the land to be residential use. If the market was left to decide the distribution of the land, some of the land would be residential and the remaining land would be commercial. The mixing of the

[16] This curve was added by this paper because McMillen and McDonald (1998) covered this prediction in their paper but did not include the curve in their graph.

land uses yields a market equilibrium value of the land that is efficient in that it maximizes the value for both residential and commercial land in that area. This has serious implications into the efficiency of the zoning ordinance used in cities today. Currently zoning does not allow for very much mixed use areas that may be suited for both residential and commercial uses. This, in turn, causes land values to fall short of their profit maximizing levels.

References

Berndt, Ernst R. (1991). The Practice of Econometrics: Classic and Contemporary. Reading: Addison Wesley.

Grieson, Ronald E., & White, James R. (1981). The Effects of Zoning on Structure and Land Markets. Journal of Urban Economics, 10, 271-285.

Kennedy, Peter (1992). A Guide to Econometrics. 3rd ed. Cambridge: The MIT Press.

Mandelker, Daniel R., & Cunningham, Roger A., & Payne, John M. (1995). Planning and Control of Land and Development (4th ed.). Charlottesville: Michie.

McMillen, Daniel P., & McDonald, John F. (1993). Could Zoning Have Increased Land Values in Chicago? Journal of Urban Economics, 33, 167-188.

--- (1998). Land Values in a Newly-Zoned City. Unpublished Essay, Tulane University.

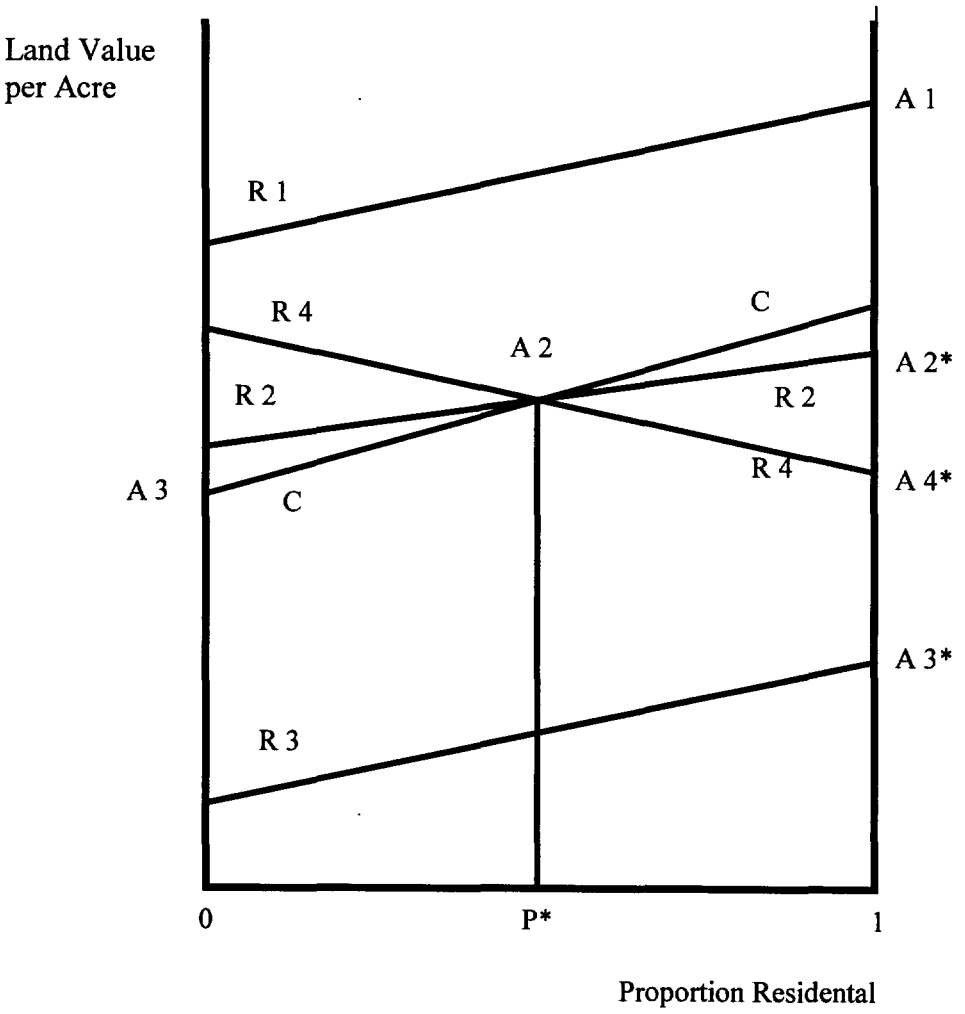
Ohls, James C., & Weisberg, Richard C., & White, Michelle J. (1974). The Effects of Zoning on Land Values. Journal of Urban Economics, 1, 428-444.

Pollakowski, Henry O., Wachter, Susan M., (1990). The Effects of Land-Use Constraints on Housing Prices. Land Economics, 66, (3), 313-324.

Pogodzinski, Michael J., & Sass, Tim R. (1991). Measuring the Effects of Municipal Zoning Regulations: A Survey. Urban Studies, 28, 597-621.

Smith, Herbert (1965). Citizen's Guide to Zoning. New Jersey: Chandler-Davis.

Figure I



Source: McMillian, Daniel & John F. McDonald (1998). Land Values in a Newly-Zoned City. Unpublished Essay. Tulane University.

Table I
Characteristic Census Data

	Baytown	Pasadena
Population	63,838	119,363
Median Houshold Income	$ 30,151	$ 28,729
Median Family Income	$ 33,891	$ 32,371

Table II
Descriptive Statistics

	Pasadena		Baytown		Total Sample	
	Before	After	Before	After	Before	After
Mean Housing Value	$ 37,878.79	$ 38,692.60	$ 44,618.96	$ 45,357.07	$ 39,200.83	$ 59,364.69
Standard Devation	17043.01799	21442.20245	27637.62	27221.01	2949.58	14345.08
Number of Data Points	1349	1696	525	761	3546	785

Difference in Means Test

Test Units	Mean Difference*	Z Values	p Values
Pasadena Before and After Zoning	-$813.81	-1.16687	0.1230
Baytown Before and After Zoning	-$738.11	-0.47363	0.3192
Pasadena and Baytown Before Zoning	-$6,740.17	-5.21531	0.0000
Pasadena and Baytown After Zoning	-$6,664.47	-5.97335	0.0000
Total Sample Before and After Zoning	-$20,163.86	-4613.08	0.0000

* Found by After Zoning - Before Zoning

Table III

Variable Names, Expected Signs, Sample Mean and Standard Deviation

Variable Name	Expected Sign	Mean	Standard Deviation	Minimum	Maximum
Transaction Amount Per Thousand	Dependent	40333.65	22424.84	1165.80	447216.89
Zoning	+/-	0.18	0.38	0.00	1.00
Baytown	+/-	0.30	0.46	0.00	1.00
Age of House	-	30.20	33.79	0.00	83.00
Living Square Footage	+	1616.63	1164.34	100.00	39000.00
Number of Stories	+	1.10	0.30	1.00	2.00
Carport	+	0.11	0.32	0.00	1.00
Garage	+	0.20	0.40	0.00	1.00
Pool	+	0.06	0.24	0.00	1.00
CDU Very Good	+	0.02	0.13	0.00	1.00
CDU Good	+	0.15	0.36	0.00	1.00
CDU Average	+/-	0.65	0.48	0.00	1.00
CDU Fair	+/-	0.16	0.36	0.00	1.00
CDU Poor	-	0.15	0.02	0.00	1.00
CDU Very Poor	-	0.00	0.06	0.00	1.00
Zoning*CDU Very Good & Good	+	0.05	0.21	0.00	1.00
Zoning*CDU Average	+/-	0.10	0.30	0.00	1.00
Zoning*CDU Fair	+/-	0.03	0.16	0.00	1.00
Zoning*CDU Poor	-	0.00	0.06	0.00	1.00

Table IV
Result of Test I

Independent Variable	Estimate	Standard Error^	Effect
Zoning	0.515332	(1.119533)	$515.33
Baytown	1.793255 *	(1.016410)	$1,793.26
Age of House	-0.231869 *	(0.123252)	-$7,834.85
Living Square Footage	0.003967 ***	(0.001125)	$4,618.94
Number of Stories	6.235657 *	(1.975893)	$1,852.90
Carport	-1.857589 *	(1.041773)	-$1,857.59
Garage	2.601319 ***	(0.742782)	$2,601.32
Pool	18.73303 ***	(2.703848)	$18,733.03
CDU Very Good	37.90560 ***	(8.201225)	$37,905.60
CDU Good	23.73336 ***	(7.214297)	$23,733.36
CDU Average	13.26743 *	(7.246580)	$13,267.43
CDU Fair	7.084548	(6.930572)	$7,084.55
CDU Poor	-3.970560	(6.902591)	-$3,970.56
Constant	17.92921 *	(9.842681)	$17,929.21
R^2	0.362402		

Observations=4329

*** Statisticly significant at the .01 level.

** Statisticly significant at the .05 level.

* Statisticly significant at the .10 level.

^ Hetorskedasticity Correct Standard Errors (White Correction)

Table V
Result of Test II

Independent Variable	Estimate		Standard Error^	Effect
Baytown	2.857589	***	(1.044535)	$2,857.59
Age of House	-0.228345	**	(0.121341)	-$7,715.77
Living Square Footage	0.003885	***	(0.001103)	$4,523.47
Stories	6.260788	***	(1.965308)	$1,860.36
Carport	-1.751552	*	(1.026744)	-$1,751.55
Garage	2.927075	***	(0.728646)	$2,927.08
Pool	19.006430	***	(2.702423)	$19,006.43
CDU Very Good/Good	22.162250	***	(7.232660)	$22,162.25
CDU Average	14.061920	*	(7.307806)	$14,061.92
CDU Fair	7.987779		(7.020089)	$7,987.78
CDU Poor	-2.588816		(6.988063)	-$2,588.82
Zoning/CDU Very Good/Good	11.310720	***	(2.199049)	$11,310.72
Zoning/CDU Average	-3.147348	***	(1.257559)	-$3,147.35
Zoning/CDU Fair	-3.921823	**	(1.767840)	-$3,921.82
Zoning/CDU Poor	-7.738036	***	(2.070214)	-$7,738.04
Constant	17.334420	*	(9.830398)	$17,334.42
R^2	0.367474			

Observations=4329

*** Statisticly significant at the .01 level.

** Statisticly significant at the .05 level.

* Statisticly significant at the .10 level.

^ Hetorskedasticity Correct Standard Errors (White Correction)