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Working Paper

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Claremont Colleges Working Papers in Economics, No. 2000-15

Provided in Cooperation with:

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Suggested Citation: Groves, Jeremy; Helland, Eric (2000) : Zoning and the Distribution of Locational Rents: An Empirical Analysis of Harris County Texas, Claremont Colleges Working Papers in Economics, No. 2000-15, Claremont McKenna College, Department of Economics, Claremont, CA

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Zoning and the Distribution of Locational Rents: An Empirical Analysis of Harris County Texas[†]

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Abstract

The Coase theorem presents two criteria for evaluating regulation. The first is how successful the regulation is at reaching the efficient outcome relative to private solutions. The second and less discussed criterion is how the regulation affects the distribution of wealth. Previous studies of the impact of municipal zoning have focused on Coase's first criteria: whether zoning raises land values overall. There has been less focus on distributional aspects of zoning. How does municipal zoning affect the wealth of participants in the property market? Most of the existing studies focus on the transfer of rents between those who have developed property and those with undeveloped property. This study estimates the transfer of wealth between owners of existing homes that results from the creation of a municipal zoning ordinance. We find that property best suited to residential use gains in value while property with relatively higher potential as commercial property experiences a decline in the value. Our results support the contention that zoning is distributive.

[†] The authors wish to thank Heather Antecol, Kelly Bedard, William Brown, Janet Smith, Alex Tabarrok and seminar participants at Claremont McKenna College for extensive and very helpful comments

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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. Shortly thereafter, all but five of the then forty-eight states passed legislation that allowed their municipalities to enact zoning ordinances. Over the past eighty years the zoning ordinance has grown from regulating size, density, and land usage to regulating signs, parking, and various other development issues. Perhaps because zoning's stated purpose is to protect residential property from the negative externalities associated with neighboring commercial development, studies of zoning's impact have focused on whether zoning is effective in raising residential housing values.¹ In essence this literature can be seen as testing whether the transaction costs associated with private solutions to the externalities of commercial development are high enough to allow regulation to improve on any Coasian solutions that might exist.

There is, however, a secondary aspect to the Coase theorem: the allocation of property rights changes the distribution of wealth. Thus, a secondary focus of the literature has been the size of the wealth transfer from commercial developers and owners of undeveloped land to residents, who are now protected from development. However, as Ellickson (1973) points out there is another type of redistribution. Housing prices have two components: the price of the land and any structures on it and an option price. The price of the option is the value attached to the possibility of changing the use of the land in the future. Some property will clearly have a higher option value as commercial development while others will be more valuable continuing as residential property. Thus zoning represents a change in property rights from homeowners who have a higher option value as commercial property to those whose land is more valuable continuing as residential property. If this supposition is correct, then previous studies suggesting zoning has a positive impact may mask a sizable redistribution of wealth between existing homeowners.

Ellickson notes that this redistribution of locational rents is likely to disadvantage the poor. Property that is ill suited to residential use is less valuable as residential property. Lower income families are more likely to live in such housing. Thus the poor benefit when the value of commercial development rises enough to warrant converting the property from residential use. When zoning deprives them of this option their wealth is reduced. Poor homeowners, unlike commercial developers, cannot diversify their wealth to protect them from changes in property

¹ For a survey of estimates of zoning's impact see Pogodzinski and Sass (1991). For a more general survey see Fischel (1985 or 1992)

rights because almost all of their wealth is contained in the price of their home. Despite the importance of distributional concerns, no study we are aware of estimates the distributional impact of zoning between existing homeowners.

This study tests the impact of zoning using data on home sales in several communities located in eastern Harris County Texas. The sample covers the period from 1988 to 1997 during which one of the communities, Baytown, passing the first zoning ordinance in Harris County (July 1995). The neighboring cities, which have no zoning ordinance, are included as a control. The data set reports the sale values for homes in both cities over a nine-year period and includes observations from before and after Baytown's zoning ordinance. The data also include information that can control for factors that impact the sale price of a home. The Baytown zoning ordinance forms a natural experiment that allows us to examine the distributional consequences of zoning. The results of this paper support the conclusion that zoning has major distributional effects between existing homeowners.

The paper proceeds as follows. The next section presents a theory of zoning's impact of property values. Section 3 provides some background information on the data set used in the analysis. Section 4 presents the results regressions on property values. Section 5 concludes the paper.

2. Externalities and Option Value

2.1 Externalities

Before proceeding to the distributional consequences of zoning it is important to discuss the externality that zoning ordinances hope to regulate. Zoning's popularity can be explained largely by the belief that it secures, or even increases, the value of the land that it regulates.² By separating negative externality producing industries from residential property, the value of

² For evidence of zoning's effectiveness see Frech and Lafferty (1984), Knapp (1987), Wallace (1988) and White (1988). For evidence that zoning has no impact see Mark and Goldberg (1986). The reason for these inconsistent results is that these studies have largely used cross-sectional data. Specifically, the effects of zoning are usually tested in cities already zoned. This makes it difficult to accurately estimate the direct effect of zoning on housing values because there is no *pre-zoning* data. The usual solution to this problem has been to estimate the impact of changes in the zoning ordinance. The difficulty is that any results gained from such a test really measure the impact of the change not zoning itself. Thus it is unclear if zonings lack of impact is due to; 1) a failure of land use controls; 2) that Coasian solutions and municipal zoning are equally effective; or 3) zoning being so effective that there are no externalities left to measure. For a more complete discussion of the problem see Fischel (1980).

residential property is increased.³ Crone (1983), for example, develops a theory of zoning based on externalities caused by conflicting land uses. Crone's theoretical model assumes that residential property is more valuable if it is not located near commercial property. The motivation for this assumption is that traffic, noise and other externalities make living near commercial property less desirable than living near other residential properties. By itself this does not constitute a market failure. It merely suggests that a 'production non-convexity' exists and that separating commercial and residential property may be Pareto improving. The market failure Crone postulates is that commercial establishments want to locate near residential areas (i.e. where customers live). Thus without secure property rights or in the presence of high transaction costs, regulations to keep property owners from selling their property for commercial development are beneficial. Put another way, if the Coase theorem fails, the resulting equilibrium is not efficient; separating residential and commercial property zoning could raise the value of residential property.⁴ The theory also suggests that homeowners with desirable residential locations benefit from having the threat of nearby commercial development removed.

To illustrate, Ellickson (1973) gives the example of the Santa Monica hills in the early 1970s. According to Ellickson the hills were exclusively residential property and there was no grocery store in the vicinity necessitating a car trip by residents. Clearly a grocery store would have liked to locate in the hills. The difficulty is that those living near the store would have suffered a loss in the value of their land due to increased traffic and noise. When zoning is implemented those living near the potential location of a store find their locational rents more secure. The person whose home could have been torn down to make way for the store, however, has lost some of the property's value.

2.2 The zonings effect on the distribution of wealth

As noted in the introduction zoning's ability to transfer rents between homeowners has not been systematically evaluated. The existing literature has implicitly treated all homeowners as if they would have been harmed by development. In fact homeowners in near proximity to the store

³For example, keeping the noise and traffic of mini-malls away from residential areas. See Cooter and Ulen 1988 p. 205 for a review of the theoretical literature on zoning.

⁴ McMillen and McDonald test their version of an externality-based model on intertemporal data. (see most recently McMillen-McDonald, 1998a and b. See also McMillen McDonald, 1991, 1993) McMillen-McDonald test a modified version of the Crone theory using pre- and post-zoning data from the city of Chicago. The authors evaluate the hypothesis that the introduction of a zoning ordinance in Chicago caused the land value to increase. The article concludes that zoning did not increase land values in Chicago after zoning was adopted.

would have been harmed while those who could have sold their homes to make way for the store would have benefited. The literature has focused on the transfer between residential property owners (who benefit—see Frech and Lafferty (1984)) and commercial developers (who may be harmed if the land is worth more as commercial property—see Knapp (1987), Wallace (1988) and White (1988)). There are several reasons to expect a transfer between existing homeowners to take place even if residents have reached the efficient solution before the zoning ordinance was enacted. In general, if a property is valuable due to its location, then owners of such a property must expend some resources ensuring that their rents are not destroyed by someone selling the property next door to build a fast food restaurant. The Coasian solution is for owners of good residential property to compensate nearby owners of property that would be more valuable if developed commercially for their loss. The need for such compensation transfers some of the locational rents to owners of lower quality commercial property raising their property values while lowering the values of high quality residential property.

There are three possible methods of compensation-enforcement: 1) direct payment, 2) suits or 3) social norms. The first appear to be uncommon although deed-restrictions and neighborhood associations do serve this function. The Coasian explanation for why few direct payments are observed is that they are costly to enforce (See Ellickson and Tarlock, 1981). The second category is more common but suffer from a similar enforcement cost. The law of nuisance provides homeowners some recourse but the burden of enforcement is on the neighbor not the person selling the property (see Ellickson, 1973 and 1977). There is little chance of capturing the importance of social norms in determining property values. It should be noted however, that neighbors have for years solved disputes without resorting to the legal system and such social norms could play a powerful role in restricting commercial development. One also suspects that these norms grow weaker in urban areas with high mobility.

What ever the cause there are clear reasons to expect that zoning will have distributional consequences. One reason why previous studies have not examined these consequences is that testing zoning's impact requires data from both before and after the passage of a zoning ordinance and a control group. In addition, any study of zonings distributional impact requires some proxy for preexisting homes' suitability for commercial development. In the next section we address our natural experiment and discuss our proxy for commercial suitability.

3. Data and Methodological Issues

3.1 Harris County Texas

In July 1995 Baytown became the largest city in Harris County Texas to adopt a zoning ordinance that restricts commercial development in residential areas. The ordinance was passed in May 1995 by a narrow margin (56.54%).⁵ The previous vote on zoning had been defeated by a 2-1 margin in 1969 and had not been put before the voters since. This suggests that zonings passage was far from certain, and at the very least housing values had not had time to fully adjust to the change in advance of the vote. The vote seems to have been motivated by concerns that unrestricted land use would result in commercial development destroying their neighborhoods, in fact, the measure was entitled the Neighborhood Conservation Act.

The zoning ordinance passed by Baytown is hierarchical in nature. The ordinance provides three land uses: 1)-neighborhood conservation districts, 2) urban neighborhoods, 3) mixed-use districts. Neighborhood conservation districts permit only single family homes, duplexes, churches, colleges, parks, schools, police stations, plus limited day care facilities and some home businesses. Urban neighborhoods include all uses in neighborhood conservation districts plus mobile homes, apartment complexes, all other daycare facilities, libraries, nursing homes plus office and retail space. Mixed use is everything else. Most notably restaurants and bars are included in mixed-use zones.⁶ Thus if property is zoned as a neighborhood conservation district it may not be used for commercial or industrial establishments. However, if the property is zoned mixed use it can be used as a residence but not industrial property. Because of this restriction we include only properties that are zoned as neighborhood conservation districts.

3.2 The Housing Market

One problem with intertemporal analysis of housing markets based on sales data is that the composition of homes in the market changes over the business cycle. Thus at the top of the business cycle new home sales (which command a higher price) make up more of the population of home sales than at the trough of the business cycle. Thus analyzing the housing market in Baytown before and after zoning is suspect. To control for this selection problem we compare the sample of Baytown home sales to a sample of sales in eastern Harris County. The area of Harris county from which the sample is drawn includes the eastern edge of the city of Houston as well as the cities of Pasadena, South Houston and Highlands and sales in unincorporated areas of the

⁵ Houston Chronicle. Sunday 5/7/95 page 37 section A. The narrow margin of passage is itself evidence of the redistributive nature of zoning.

⁶ Houston Chronicle Sunday 5/7/95 page 37 section A.

county. No other city in Harris County has a zoning ordinance nor has any other city passed one during the sample period. In effect our estimation strategy will be to control for all of the characteristics of a given property and the market that we can and then estimate the impact of location before and after the July 1995 zoning ordinance was passed in Baytown. Thus we will attribute any change in the difference between the value of location in Baytown relative to the rest of eastern Harris County to zoning.

In order to match the two samples all duplexes and apartments were dropped from the eastern Harris county sample (they were eliminated from the Baytown sample by our use restriction). All of the sales figures have been translated into real 1988-dollar values. The constructed the data set includes 3,158 home sales in eastern Harris County (excluding Baytown) and 1,003 home sales in Baytown during the 9-year period. Of the Baytown sales, 383 occurred before the zoning ordinance while 620 occurred after the ordinance. In the eastern Harris county sample the numbers are 1,307 and 1,851 respectively.

The data-set used in this paper is compiled from the County Appraiser's District of Harris County, Texas, and that office's Sales Book. These Sales Books include housing transactions that have occurred since 1988 through July 1997 when the sample was created. The sample is clearly made up disproportionately of more recent home sales. Less than 6% of the sales occur before 1992. The data set includes the date of sale, the sale value, the transaction amount (the sale price of the property), the amount of land involved in the sale, 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 of amenities. The data set does have one limitation. It contains no information on commercial or undeveloped property. The omission of commercial property is unfortunate as it prevents us from assessing any change in rents create by zoning that accrue to commercial property owners.

3.3 The Condition, Desirability, and Utility Index and Location Characteristics

The remaining difficulty with estimating the redistributive aspect of zoning is finding a suitable proxy for a residential property's option value as commercial property. The data set includes 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 four categories labeled very

good/good, average, fair, poor/very poor and is hierarchical.⁷ One way to assess the CDU values usefulness as a measure of the property's quality is the relative size of a category's impact on transaction value. We expect a hierarchy of values with CDU very good/good being highest and CDU poor/very poor the lowest.

The most important aspect of the CDU for this study is that it provides information about the environment surrounding a property. The CDU value is assigned by the appraiser based on a point system that adds points for desirable aspects, such as lake front property or a clean neighborhood, and deducts 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.^{8, 9} The second part of the CDU assessment deals with the condition of the house. If the house is in poor shape, i.e. in need of paint or a new roof, it will be marked down.

We use the CDU as a proxy for locational rents. The CDU is in part designed to capture the suitability of the land for residential use. Given that land is deemed less suitable for residential use if it is near major roads, highways, or commercial areas we conjecture that a lower CDU level for residential land corresponds to a higher value for commercial uses. The proxy is not perfect. Ideally we would like the value of the land if it were to be developed commercially. This is not available, however, and we are forced proxy this value. The noise in our proxy arises from the portion of the CDU that captures the condition of the home. We construct our test to capture only the locational aspects of the CDU. By examining the change in the difference of each CDU categories' impact on both land value and transaction amount we are able to isolate locational rents. Because there is no reason why homes in better condition should enjoy an increase in value after zoning any impact detected by the interaction terms is due to the locational aspects of the CDU. Our theory also predicts that zoning will impact homes in the various CDU categories differently. After zoning high value CDU properties in Baytown are predicted to enjoy an increase in value relative to properties in the eastern Harris county sample while lower CDU valued properties are predicted to depreciate.

⁷ Due to limited cell size the top and bottom cells were combined into a single cell. Thus homes classified as very good or good are simply reported here as one category as are homes listed as poor or very poor.

⁸ The properties score or the reason why points are assigned or deducted is not generally included in the data.

⁹ For example, homes lose points if they are on busy streets, are in high traffic areas, near apartment complexes, adjacent to church parking lots, or have empty adjacent lots. Homes gain points if they are near parks, on minor-low traffic streets or cul-de-sacs.

As noted above CDU also measures the condition of the property not just its location. There are two ways in which CDU could fail as a proxy for locational rents. The first is that properties listed as average or fair could in fact have locations that are desirable for commercial development but are in excellent condition and so are given a higher CDU rating. Alternatively it could be that the very poor/poor CDU properties includes both homes in poor residential locations and homes in truly awful condition. If this is the case, the very poor/poor zoning coefficient would be bias downward. Ideally we would like to quantify exactly which homes are given a low CDU rating because they are in locations suited for commercial use and which are merely in poor condition.

The second proxy for locational rents is the characteristics of the area surrounding the property. Each of the home sales in both the Baytown and eastern Harris county samples were located using Microsoft Expedia Streets 98. The program displays certain "points of interest." A series of variables were created which equal one if the home is 1) on a main road (defined as a major thoroughfare or 4 lane city street); 2) a dead-end street; 3) within a half mile of a fast food restaurant on the same street; 4) within half a mile of a nightclub on the same street; or 5) within half a mile of a highway on ramp. These five variables are designed to measure the home's suitability for commercial development. For example homes on major thoroughfares or near nightclubs, on ramps or fast food restaurants are more likely to be developed commercially than other properties. By contrast dead-end streets are less likely to be developed and owners of these properties should either find their option value increases after zoning due to the regulatory protection or be unaffected by the change.

This proxy has the advantage over the CDU of making commercial suitability explicit. One difficulty with using locational characteristics is that it is difficult to quantify desirable locations, which are now protected. For this reason, as well as the obvious check on robustness, both measures of locational rents are used in the analysis.

4 Regression Analysis

4.1 Preliminary Data Analysis

Column 2 of Table 1 presents a simple difference regression. The dependent variable is the natural log of the transaction value of the property. The independent variables in column 1 are the CDU for the property, the CDU interacted with a dummy variable equaling one after July 1995 (the date zoning took effect), and the CDU interacted with the July 1995 variable and another

dummy variable equal to one for properties sold in Baytown. The results indicate that post zoning Baytown properties rated as very good or good on the CDU index experienced a 3.9% increase in value relative to properties not covered by a zoning ordinance. Given the mean of the logged transaction value (essentially the median) is \$35,596 the simple difference in means test suggests that zoning added over \$1,400 dollars to homes with a desirable location. The results indicate that average and fair CDU properties experienced a slight drop post zoning on the order of about one percent. Although only the average CDU post-zoning coefficient is significant neither effect substantially alters the value of these properties. For homes with a very poor or poor CDU the July 1995 coefficient is not significant but the post-zoning interaction is negative and significant. Homes with the least desirable residential locations experience almost a five- percent drop in their sale price: almost an \$1,800 decline. If the CDU is a proxy for locational rents, the result suggests that zoning negatively impacts the value of these properties because the owners cannot sell their property of commercial development.

Further evidence of the decline of the option value of homes with desirable commercial locations is evident in the column 4 of Table 1. In column 4 the dependent variable is again the natural log of the transaction price. The independent variable is now the characteristics of the property detailed above. Similar to the results above homes on main roads, near nightclubs and those near highway on ramps all experience a decline post zoning (4, 5 and 7% respectively) and homes on dead end streets rise in value by about 1%. Although the results in column 4 do not inform us about the protection offered by zoning they do suggest that homes with a higher commercial option value do pay a penalty for zoning.

Although the difference in means test described above are consistent with the theory there are many other factors which determine the value of a property and the land on which it is located. The difficulty is that some of these may be correlated with CDU. In the next section we estimate a model of transaction price that includes other regressors.

4.2 Regression Technique

We estimate a least squares model of the form,

$$\begin{aligned}
\ln(\text{transaction value}_i) = & \sum_{k=1}^4 g_k CDU_{ki} \\
& + \sum_{k=1}^4 d_k (CDU_{ki} * July_95) \\
& + \sum_{k=1}^4 q_k (CDU_{ki} * July_95 * Baytown) \\
& + \alpha X_i + j_c + I_t + e_{it},
\end{aligned} \tag{1}$$

where the independent variable is the natural log of the transaction value of property i in town c , and CDU is a dummy variable representing the Condition Desirability and Utility value (k = very good/good, average, fair, poor/very poor). July_95 is a dummy variable that takes the value one for homes sold after July 1995, when Baytown institutes zoning. *Baytown* is a dummy variable equal to one for homes sold in Baytown. X refers to the control variables described below, j_c are city specific intercept variables (c denotes the census area: Pasadena, Houston, South Houston, Highlands, Baytown or the unincorporated county), I_t are dummy variables for each year 1989 to 1997 and e_{it} is the error term.

An alternative version of the model is estimated using the location characteristics,

$$\begin{aligned}
\ln(\text{transaction value}_i) = & \sum_{k=1}^4 g_k Location_Charateristics_{ki} \\
& + \sum_{k=1}^4 d_k (Location_Charateristics_{ki} * July_95) \\
& + \sum_{k=1}^4 q_k (Location_Charateristics_{ki} * Baytown * July_95) \\
& + \alpha X_i + j_c + I_t + e_{it},
\end{aligned} \tag{2}$$

In addition to census area intercepts both specifications are estimated using fixed effects for the census tract rather than the census location.

4.3 Control Variables

The Sales Book data set contains information on several characteristics of a property that may determine the selling price of a home. Table 2 lists all of the variables means, standard deviations, and minimum and maximum values.

We propose that the transaction amount is a function of characteristics of the home, the CDU, neighborhood characteristics, and the size of the lot. Subtracting the year the home was built from the year the house was sold creates age. Given that older houses are in some since less

desirable due to wear and tear, this coefficient is expected to be negative. The amount of living space in the home being sold, home area, is expected to have a positive impact on selling price. If the house has two Stories it is also expected to have a higher value. Carport, Garage, and Pool are dummy variables equaling 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. We also include the grade of construction for the home. This is captured by a series of dummy variables for grade A (best quality), B and C. Grade D (the lowest) is omitted to avoid collinearity with the CDU indices. Because the demand for houses is higher in the summer a dummy variable, labeled summer is included. Summer is set equal to one for homes sold in June, July or August. Finally the size of the lot on which the house is located is included.

In addition, each home in the data set is matched to one of 65 census tracts. This allows for the inclusion of various neighborhood characteristics. Included in the analysis is the population density of the census tract, the percentage of the census tract that are member of an ethnic minority (either black or hispanic), the percentage of home in the tract that are owner occupied, the percentage of the population of the census tract whose income falls below the poverty line, the percentage of the tract's population with a college degree, the average commute to work from the census tract and the median income in the census tract. Because economic conditions can also affect the housing market the mortgage interest rate two months prior to the date of sale and the unemployment rate are also included (See Curran and Schrag, 1998). We also include dummy variables for each year 1989 to 1997 and either dummy variables for the census area (Houston, South Houston, Pasadena, Highland, Baytown or, if no area name was listed or the sale is in one of the smaller communities in eastern Harris County; unincorporated Harris County) or a dummy variable for each of the 65 census tracts represented in the data. As mentioned above the sample is weighted disproportionately toward post 1994 home sales. For this reason we weight the sample by the total existing home sales for the south.¹⁰

4.4 Control Variable Results

The results for the transaction amount regression are presented in Table 3. Column 1 contains the estimates of the CDU regression. The model fits the data fairly well. For example, older houses are worth less; a one standard deviation increase in the age of a house reduces its logged sale price by 1.3%. In addition, larger homes have higher sale prices; moving from a 1611

square foot dwelling to a 2751 square foot dwelling (one standard deviation) raises the log of the selling price by 4.6%. Similarly a second story increases property value by 9%, a garage raises the value by .6% and a pool raises the value by 1.8%. Homes with A grade construction command a 6% premium over D grade construction while B and C grade homes command 5 and 2% respectively. Finally the size of the increases the natural log of the sale price of the home. A one standard deviation increase in the lot size produces a 3% change in the logged sale price.

Several of the neighborhood characteristics are also important determinates of the sale price of a home. A one standard deviation in the population density of the census tract increases log of the value of the property by one fifth of a percent. Homes located in census tracts with a higher percentage of the population that are black or Hispanic have lower log transaction prices. A one standard deviation increase in the percentage of the census tract that is black or Hispanic reduces the natural log of the property's price by .2%. A one standard deviation increase in the percentage of the homes in the census tract that are owner occupied increases the logged sale price of a property by .2%. A one standard deviation increase in the percentage of the census tract's residence with at least four years of college increases the logged sale price by 1%. Contrary to expectation houses sold in the summer are worth about .3% less and higher interest rates and unemployment rates are associated with higher logged sale prices. One reason for the anomalous sign on unemployment and interest rates can be found in the year dummy variables, which clearly demonstrate a cyclical pattern to housing demand. Housing prices are highest in recent years (an economic expansion) and lowest in during the recession of the early 1990s. Thus the unemployment and interest rate variables are picking up within year changes in housing demand.

4.5 CDU Results

The impact of zoning on can be ascertained from the post July 1995 CDU coefficient for Baytown properties (i.e. those properties sold under a zoning ordinance). Thus the impact of zoning is q_k from equation 1 or 2. The results are presented in column 1 Table 3. For homes listed as having a good or very good CDU zoned properties are worth about .8% more than their non-zoned counterparts. The mean of the logged value of homes in the sample is 10.48 or \$35,596. Thus zoned homes with a very good or good CDU gained \$304 dollars due to zoning. Neither the average nor the fair CDU post zoning coefficients are statistically significant although

¹⁰ The existing home sales data is produced by the National Realtors Association and is contained in the 1997 Statistical Abstract of the United States.

the coefficient on post zoning fair CDU properties has a p-value of .106. Both are negative and of similar magnitude to the very good/good CDU impact.

The results are larger for homes with a very poor or poor CDU rating. These are the properties we hypothesized has locations that are the most suitable for commercial development. These properties experienced a 3% fall after zoning. Given the mean value listed above this impact translates into a \$1,196 drop in the sale price. This finding is consistent with our hypothesis that zoning transfers locational rents from those homeowners with desirable residential locations to homeowners whose property could be developed commercially. Taken at face value these numbers suggest that zoning transferred locational rents from owners of very poor/poor CDU properties to those with very good/good CDU properties. There are 203 properties with a very good or good CDU sold after July 1995 in Baytown while there are only 15 very poor/poor properties. Thus zoning's beneficiaries in our sample received \$61,712 while its victims lost only \$17,940. These results are robust to the inclusion of census tract fixed effects: see column 2 of Table 3.

4.6 Location Characteristic Results

As noted above the property's CDU measures both the location and condition of the home. This may cause a downward bias in our estimates if only a few of the low CDU homes in the sample are actually in areas that have potential commercial development. For this reason we would like to isolate those homes that are directly affected by zoning. Following our earlier strategy we include the location characteristics detailed above. The results are displayed in Column 3 of Table 3. There several qualifications are necessary when interpreting the results. The first is that the number of homes in each of the location characteristic cells is small. There are 19 homes sold after July 1995 in Baytown that are located on major streets, 54 on dead end streets, 13 within a half mile of a fast food restaurant, 8 within a half mile of a nightclub and 9 within a half mile of a freeway or highway on ramp or intersection. The second qualification is that unlike the CDU values the location characteristics often overlap. For example, four of the homes near fast food restaurants were also on major streets and 2 are within a half-mile of a highway on ramp.

These qualifications aside, the results are largely consistent with expectations. Properties on a main road experience a 4% decline in price after zoning which translates into a \$1,525 drop in property values. Properties near fast food restaurants and nightclubs experience a drop of 2.8% and 4% respectively: a loss of \$1,025 and \$1,441 respectively. Although the post zoning coefficient for highway properties is statistically significant the impact is small, only .1% or about

\$37. Although these results do not quantify the gain in property values that zonings protection creates they do suggest properties with a high commercial option value transferred a nontrivial portion of their rents to those properties with more desirable locations. Given the sample sizes for post zoning Baytown characteristics our estimates suggest that property owners with homes on major streets, near fast food restaurants or nightclubs or near highway on ramps lost \$54,161. Of course there are potentially other characteristics of a property not controlled for in our regression that might be altered by zoning so these results must be taken as merely suggestive. As column 4 of Table 3 shows the location characteristic regression results are also robust to the inclusion of census tract fixed effects.

The final two columns of Table 3 show the results when both the location characteristics and property CDU are included. Consistent with our expectations the results for the location characteristics are similar and the very good/good CDU results are also unaltered. The very poor/poor CDU coefficient is now positive and not significant suggesting that very poor/poor CDU and the location characteristics are measuring similar effects. The results are again robust to the inclusion of census tract fixed effects rather than area intercept terms.

Taken together these results suggest that zoning ordinances involve a transfer of locational rents. By preventing or at least making it more difficult for homeowners with desirable commercial locations from converting their property zoning reduces the option value of the lots. Both the CDU and location characteristic regressions indicate that homes with more desirable commercial locations experience a decline in their sale price after the passage of a zoning ordinance. The CDU regressions also indicate that those homes with very desirable residential locations experience an increase in value presumably resulting from the protection against externality producing development.

The results cannot be taken as evidence for or against zoning. Although the results show a larger overall increase in very good/good CDU properties than the total fall in very poor/poor properties or properties with desirable commercial locations we do not know the size of the transfer from those with undeveloped land or business owners. Nevertheless the results are a departure from previous research which has shown either an increase in residential property values after zoning and a reduction in commercial lands value or no effect. Demonstrating that zoning transfers locational rents between homeowners adds a new dimension to efforts to assess zoning's impact.

V. Conclusion

When Baytown voters passed their first zoning ordinance they created a natural experiment of the distributional effects of zoning. We are able to isolate zoning's effect by using the home sales from other locations in eastern Harris County, Texas, which did not pass zoning ordinances. The results indicate that zoning does in fact redistribute wealth between existing homeowners. In effect a change in the zoning ordinance changes the property rights over locational rents: the value of the properties surroundings. Zoning also changes the option value of a property. By removing the option of commercial development those properties best suited to residential use will fair better than those better suited to commercial use.

The CDU index and various characteristics of the property's location measure the suitability for residential use. 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 property when zoned residential. Those areas categorized as average, fair, or poor or very poor are less ideally suited for residential land use experience either no effect or a fall in the value of their land after zoning the zoning ordinance is passed. The results are consistent with the theory. Zoning raises the value of properties best suited to residential use by protecting them from the threat of nearby future commercial development. Those candidates for nearby future development are, however, harmed by the change in property rights. While governments transfer wealth between citizens for a variety of reasons there is cause for concern about zoning's 'tax.' It seems likely that those owning homes with less desirable locations also have lower incomes than those with more desirable residential locations. If this is true, zoning represents a regressive tax.

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Table 1: Difference in means test

Variable	Coefficient	Variable	Coefficient
Very Good/Good	10.85*** (.0296)	Constant	10.51*** (.0084)
Average	10.5*** (.0136)	Main Road	-.137 (.101)
Fair	10.086*** (.027)	Main Road*Post July 1995	.066 (.142)
Very Poor/Poor	9.62*** (.062)	Main Road*Post July 1995*Baytown	-.473*** (.155)
Very Good/Good*Post July 1995	-.191*** (.04)	Dead End Street	-.047 (.047)
Average*Post July 1995	.032* (.018)	Dead End Street*Post July 1995	.0901 (.069)
Fair*Post July 1995	.105*** (.037)	Dead End Street*Post July 1995*Baytown	.144* (.085)
Very Poor/Poor*Post July 1995	-.045 (.092)	.5 Mile from Fast Food Restaurant	-.686*** (.102)
Very Good/Good*Post July 1995*Baytown	.427*** (.041)	.5 Mile from Fast Food Restaurant*Post July 1995	.21 (.15)
Average*Post July 1995*Baytown	-.086*** (.028)	.5 Mile from Fast Food Restaurant*Post July 1995*Baytown	-.234 (.193)
Fair*Post July 1995*Baytown	-.081 (.053)	.5 Mile from Nightclub	.0902 (.149)
Very Poor/Poor*Post July 1995*Baytown	-.46*** (.132)	.5 Mile from Nightclub*Post July 1995	-.567*** (.19)
		.5 Mile from Nightclub*Post July 1995*Baytown	-.546*** (.227)
		.5 Mile from Highway on ramp	-.248*** (.049)
		.5 Mile from Highway On ramp*Post July 1995	.102* (.062)
		.5 Mile from Highway On ramp*Post July 1995*Baytown	-.719*** (.174)

* Significant at the .10 level
** Significant at the .05 level
*** Significant at the .01 level
Note: Standard Errors in parentheses

Table 2: Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
Transaction Price (dollars)	40196.96	22269.44	1165.80	447216.9
Very Good/Good CDU	.169	.3752	0	1
Average CDU	.6438	.4789	0	1
Fair CDU	.1603	.3669	0	1
Very Good/Good CDU*July 1995	.1127	.3163	0	1
Average CDU*July 1995	.3749	.4842	0	1
Fair CDU*July 1995	.0925	.2898	0	1
Very Poor/Poor				
Very Poor/Poor*July 1995	.0137	.1163	0	1
Very Good/Good CDU*July 1995*Baytown	.04879	.2154	0	1
Average CDU*July 1995*Baytown	.075	.2634	0	1
Fair CDU*July 1995*Baytown	.0216	.1455	0	1
Very Poor/Poor*July 1995*Baytown	.0036	.0599	0	1
Is the property located on a main road? (1=yes)?	.0168	.1286	0	1
Main road *July 1995	.0108	.1034	0	1
Main road *July 1995*Baytown	.0046	.0674	0	1
Is the property located on a dead end street (1=yes)?	.0654	.2472	0	1
Dead end *July 1995	.0363	.187	0	1
Dead end *July 1995*Baytown	.013	.1132	0	1
Is the property within .5 miles of a fast food restaurant?	.015	.1221	0	1
Fast food *July 1995	.0082	.09	0	1
Fast food *July 1995*Baytown	.0031	.0558	0	1
Is the property within .5 miles of a nightclub?	.0096	.0976	0	1
Nightclub *July 1995	.00649	.0803	0	1
Nightclub *July 1995*Baytown	.0019	.0438	0	1
Is the property within .5 miles of a highway on ramp?	.0697	.2547	0	1
Highway *July 1995	.0416	.1996	0	1
Highway *July 1995*Baytown	.0022	.0465	0	1
Home Age (years)	27.71	14.024	0	80
Home area (square feet)	1611.24	1140.98	100	39000
Two Story (1=yes)	.1031	.3041	0	1
Garage (1=yes)	.1954	.3965	0	1
Carport (1=yes)	.1137	.3175	0	1
Pool (1=yes)	.0642	.2451	0	1
Grade A construction (1=yes)	.0005	.0219	0	1
Grade B construction (1=yes)	.054	.2267	0	1
Grade C construction (1=yes)	.8188	.3852	0	1
Grade D construction (1=yes)	.124	.3296	0	1
Population density of the census tract	3664.84	2061.208	10.667	14840
% black or Hispanic in census tract	28.553	14.5751	4.3	98
% owner occupied in census tract	61.118	17.1797	3.1	93.8
% Poverty in census tract	11.1038	6.4254	0	43.8
% of census tract with college education	13.6916	7.7945	0	48.3
Average commute to work	80121.7842	60397.7142	455	237439
Median family income in census tract	33513.7431	8744.1454	13690	58132
Interest rate two months before sale	8.0962	.809	6.8	11
Unemployment rate two months before sale	6.078	.4607	5.4	7.9
Was the home sold in the summer (1=yes)	.279	.4486	0	1
Land area (square feet)	10239.027	15079.531	0	283140
Was the home in Baytown? (1=yes)	.241	.4278	0	1
Was the home in the unincorporated county? (1=yes)	.1329	.3395	0	1
Was the home in Highlands? (1=yes)	.0228	.1494	0	1
Was the home in Houston? (1=yes)	.2177	.4128	0	1
Was the home in South Houston? (1=yes)	.0264	.16045	0	1
Was the home in Pasadena? (1=yes)	.3593	.4799	0	1
Year 1989	.0267	.1612	0	1
Year 1990	.0272	.1626	0	1
Year 1991	.0209	.1431	0	1
Year 1992	.00817	.09	0	1
Year 1993	.0106	.1023	0	1
Year 1994	.2127	.4093	0	1
Year 1995	.2696	.4438	0	1
Year 1996	.3754	.4843	0	1
Year 1997	.0447	.2067	0	1

Table 3: Regression Results

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Very Good/Good CDU	.687*** (.0597)	.6322*** (.0578)	--	--	.759*** (.07)	.695*** (.068)
Average CDU	.533*** (.0546)	.481*** (.53)	--	--	.609*** (.066)	.549*** (.064)
Fair CDU	.3787*** (.0567)	.323*** (.055)	--	--	.456*** (.669)	.387*** (.065)
Very Good/Good CDU*July 1995	.143*** (.04266)	-.02 (.042)	--	--	.14*** (.042)	-.022 (.041)
Average CDU*July 1995	.221 (.0888)	.0489* (.0289)	--	--	.213*** (.029)	.043 (.029)
Fair CDU*July 1995	.2948*** (.0398)	.115*** (.039)	--	--	.282*** (.04)	.108*** (.039)
Very Poor/Poor*July 1995	.1698** (.0799)	.012 (.078)	--	--	.231*** (.094)	.077 (.092)
Very Good/Good CDU*July 1995*Baytown	.0924** (.0424)	.0855** (.041)	--	--	.095** (.043)	.092** (.041)
Average CDU*July 1995*Baytown	-.029 (.0324)	-.0353 (.0293)	--	--	-.009 (.031)	-.102 (.03)
Fair CDU*July 1995*Baytown	-.0802 (.0497)	-.0755 (.049)	--	--	-.009 (.503)	-.014 (.05)
Very Poor/Poor*July 1995*Baytown	-.334*** (.113)	-.431*** (.11)	--	--	.201 (.137)	.09 (.134)
Is the property located on a main road? (1=yes)?	--	--	-.0114 (.078)	-.0045 (.074)	.054 (.075)	.038 (.072)
Main road *July 1995	--	--	.16 (.108)	.139 (.103)	.064 (.105)	.104 (.101)
Main road *July 1995*Baytown	--	--	-.45*** (.118)	-.451*** (.113)	-.409*** (.115)	-.44*** (.111)
Is the property located on a dead end street?	--	--	-.117*** (.037)	-.095*** (.035)	-.071** (.036)	-.073** (.035)
Dead end *July 1995	--	--	.083 (.054)	.023 (.051)	.04 (.052)	.024 (.05)
Dead end *July 1995*Baytown	--	--	.0489 (.066)	.049 (.062)	.0102 (.065)	.0087 (.062)
Is the property within .5 miles of a fast food restaurant?	--	--	-.316*** (.078)	-.279*** (.074)	.056 (.086)	.05 (.083)
Fast food *July 1995	--	--	.152 (.117)	.144 (.111)	-.044 (.122)	-.052 (.118)
Fast food *July 1995*Baytown	--	--	-.296*** (.146)	-.358*** (.139)	-.347** (.149)	-.342*** (.143)
Is the property within .5 miles of a nightclub?	--	--	.182 (.113)	.108 (.107)	.356*** (.112)	.255*** (.107)
Nightclub *July 1995	--	--	-.467*** (.144)	-.419*** (.137)	-.353*** (.146)	-.297*** (.14)
Nightclub *July 1995*Baytown	--	--	-.409*** (.173)	-.398*** (.165)	-.555*** (.177)	-.506*** (.171)
Is the property within .5 miles of a highway on ramp?	--	--	-.124*** (.039)	-.067* (.0375)	-.063* (.038)	-.026 (.037)
Highway *July 1995	--	--	.0896* (.048)	.0499 (.045)	.041 (.047)	.039 (.045)
Highway *July 1995*Baytown	--	--	-.65*** (.133)	-.675*** (.13)	-.647*** (.129)	-.677*** (.128)
Age of Home	-.0098*** (.0006)	-.0101*** (.006)	-.0109*** (.0063)	-.012*** (.007)	-.01*** (.0006)	-.01*** (.007)
Home area	.4E-4*** (.5E-5)	.38 E-4*** (.5 E-5)	.4 E-4*** (.5 E-5)	.4 E-4*** (.5 E-5)	.4 E-4*** (.5 E-5)	.4 E-4*** (.5 E-5)
Two Story	.096*** (.028)	.102** (.02)	.107*** (.021)	.109*** (.204)	.095*** (.021)	.101*** (.02)
Garage	.0694 (.0154)	.045** (.015)	.068*** (.016)	.046*** (.153)	.071*** (.015)	.047*** (.015)
Carport	.0051 (.0187)	.026 (.018)	.004 (.019)	.023 (.018)	-.0004** (.019)	.021 (.018)
Pool	.186*** (.0247)	.171*** (.024)	.193*** (.025)	.173*** (.024)	.182*** (.024)	.168*** (.023)

Table 3: Regression Results (continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Construction Grade A	.6701*** (.263)	.618*** (.251)	.698*** (.27)	.582*** (.255)	.656*** (.261)	.6*** (.248)
Construction Grade B	.556** (.0402)	.515*** (.049)	.698*** (.039)	.618*** (.041)	.553*** (.04)	.515*** (.042)
Construction Grade C	.283** (.0222)	.232*** (.024)	.341*** (.223)	.283*** (.024)	.278*** (.022)	.231*** (.024)
Population density of the census tract	.15 E-4*** (.4 E-5)	--	.2 E-4** (.4 E-5)	--	.2 E-4*** (.4 E-5)	--
% black or hispanic in census tract	-.0015** (.0079)	--	-.0017*** (.0008)	--	-.001* (.0007)	--
% owner occupied in census tract	.0014 (.00067)	--	.017** (.0069)	--	.148** (.0007)	--
% Poverty in census tract	.0023 (.002)	--	-.0011 (.002)	--	.002 (.002)	--
% of census tract with college education	.0136** (.0019)	--	.015*** (.0019)	--	.014*** (.002)	--
Average commute to work	-.1 E-6 (.4 E-6)	--	-.3 E-6* (.1 E-6)	--	-.1 E-6 (.1 E-6)	--
Median family income in census tract	-.4 E-5* (.2 E-5)	--	-.5 E-5** (.2 E-5)	--	-.4 E-5* (.2 E-5)	--
Interest rate two months before sale	.233*** (.014)	.014 (.0181)	.18*** (.012)	-.011 (.015)	.235*** (.014)	.173 (.018)
Unemployment rate two months before sale	.582*** (.03)	.0135 (.044)	.57*** (.031)	-.019 (.042)	.583*** (.03)	.02 (.043)
Summer	-.0399*** (.0136)	.012 (.0133)	-.018 (.014)	.017 (.013)	-.044*** (.013)	.008 (.013)
Lot size	.4 E-5*** (.4 E-6)	.4 E-5*** (.4 E-6)	.4 E-5*** (.4 E-6)	.4 E-5*** (.4 E-6)	.4 E-5*** (.4 E-6)	.4 E-5*** (.4 E-6)
Year 1989	.684*** (.104)	.105 (.105)	.799*** (.107)	.144 (.106)	.685*** (.104)	.113 (.104)
Year 1990	1.026*** (.105)	.121 (.112)	1.14*** (.108)	.148 (.113)	1.02*** (.105)	.126 (.111)
Year 1991	1.0002*** (.107)	.093 (.144)	1.08*** (.109)	.116 (.114)	.99*** (.106)	.094 (.113)
Year 1992	.694*** (.119)	.13 (.118)	.733*** (.122)	.161 (.12)	.694*** (.118)	.137 (.117)
Year 1993	1.047*** (.116)	.127 (.122)	1.03*** (.117)	.124 (.12)	1.04*** (.115)	.134 (.121)
Year 1994	1.366*** (.102)	.1322 (.119)	1.37*** (.104)	.141 (.116)	1.36*** (.101)	.142 (.119)
Year 1995	1.55*** (.105)	.1404 (.128)	1.69*** (.108)	.141 (.128)	1.56*** (.105)	.158 (.128)
Year 1996	1.77*** (.1104)	.154 (.14)	1.97*** (.113)	.159 (.141)	1.77*** (.11)	.173 (.139)
Year 1997	1.96*** (.117)	.191 (.15)	2.15*** (.119)	.182 (.15)	1.96*** (.116)	.213 (.149)
Area Intercepts	Yes	No	Yes	No	Yes	No
Census Tract Intercepts	No	Yes	No	Yes	No	Yes
* Significant at the .10 level						
** Significant at the .05 level						
*** Significant at the .01 level						
Note: Standard Errors in parentheses						

Table 4: Estimated Impact of Zoning

CDU	Zoning	No zoning	Percentage Change
Predicted value for CDU Very Good/Good (in natural logs)	10.75	10.84	.9
Predicted value for CDU Average (in natural logs)	10.68	10.65	-.3
Predicted value for CDU Fair (in natural logs)	10.6	10.52	-.8
Predicted value for CDU Very Poor/Poor (in natural logs)	10.09	9.76	-3
Location Characteristics			
Predicted value for Is the property located on a main road? (in natural logs)	10.74	10.28	-4
Predicted value for properties located on a dead end street? (in natural logs)	10.56	10.61	.4
Predicted value for properties within .5 miles of a fast food restaurant? (in natural logs)	10.43	10.73	-2.9
Predicted value for properties within .5 miles of a nightclub? (in natural logs)	10.30	9.9	-4.1
Predicted value for properties within .5 miles of a highway on ramp? (in natural logs)	10.33	10.32	-.1