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Ignoring Whistle Bans and Residential Property Values: An Hedonic Housing Price Analysis

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I. Executive Summary

The rail industry has maintained that whistle bans imposed by municipalities increase the probability of train-vehicle accidents, and two recent studies conducted for the Federal Railroad Administration support that hypothesis. In 1991, Conrail began ignoring whistle bans that had been enacted by local communities along its train lines. Critics of that policy argued that the whistle noise would have permanent detrimental impacts on residential housing markets.

To test whether housing markets are impacted, data for more than 12,000 single-family residential home sales in two Ohio communities (Middletown and Niles) over the period 1988-1997 are evaluated using an hedonic housing price model. The hedonic model treats housing as a bundle of characteristics. These characteristics include features of the home itself (e.g., bedrooms, bathrooms, size of garage, lot size, etc.) as well as neighborhood attributes (e.g., air quality, school district, proximity to local hazards, proximity to noise, etc.). The sale price of the house is then related to the list of structural and neighborhood features using linear regression analysis. From this estimated relationship, implicit prices can be derived for each of the structural and neighborhood attributes. For example, one can determine from this hedonic relationship how much an additional bedroom adds to the price of a housing unit, holding other characteristics constant. Likewise, the influence of proximity to rail crossings, and rail lines can also be determined. The findings indicate that, other things equal, an increase in one additional rail line within ¼ mile of a property lowers sale prices by approximately 2.1% in Middletown and 2.8% in Niles. An evaluation of the independent influence of railroad crossings (again holding the impact of other factors constant) reveals that being within approximately ½ mile of a Conrail crossing lowers property values by approximately 6.2% in the Middletown area, and by 17.4% in the Niles area. In contrast, being within ½ mile of a rail crossing for another rail company that is not sounding whistles, lowers sale prices 7.8% and 8.4% for Middletown and Niles respectively, other things equal. In addition, there is weak evidence of increased sale prices with greater distance from the crossing (i.e., a so-called housing price gradient). For the Middletown area, this price gradient at Conrail crossings results after the whistle ban is ignored (i.e., housing prices rise by about 4.5% over the distance from the crossing to the edge of the audible range for train whistles). However, the impact in Middletown does not appear to remain statistically important once temporary vs. permanent impacts are distinguished. In the Niles region, the price impact of proximity rises temporarily after ignoring the ban, but the detrimental effect of the action taken by Conrail subsides after 3.1-4.5 years.

These findings suggest that although the housing market does reflect the influence of proximity to rail lines and rail crossings, there does not appear to be a permanent impact resulting from the actions taken by Conrail. Rather, home prices in the vicinity of train crossings appear to reflect the likelihood that train whistles will be used sometime in the future, even if they are not currently being blown.

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II. Introduction

In 1992 and 1995, the Federal Railroad Administration (FRA) issued the findings of two separate studies of the influence of train whistle bans on fatal accidents. The findings revealed that substantially lower accident rates at train crossing where whistles are blown as compared to areas where no whistles are blown. In addition to the societal costs resulting from the loss of human life, fatalities are also costly to railroads. Specifically, the FRA estimates that each fatality costs the railroad approximately $500k (get the source for this), In October of 1991, Conrail unilaterally decided to ignore the whistle bans in the cities in which it operates. Critics of this decision contend that residential property markets are detrimentally impacted by Conrail's action.

There are a number of studies in the research literature which evaluate the influence of noise on residential annoyance levels. For example, Osada (1991) evaluates community reaction to aircraft noise in the vicinity of Japanese airports. Using discriminant analysis, the author finds that annoyance rates are highly related to noise levels and they also depend on personal characteristics of the respondent. In addition, they compare their findings on airport noise with that of other studies evaluating road traffic and train noise. Their findings suggest similar responses to noise across the various sources, and the different time periods considered. Björkman (1991) uses a dose-response model to investigate how road traffic noise levels and event frequency influence annoyance levels. Björkman concludes that the number of noise events increases annoyance rates up to a point, beyond which there is no additional reaction to additional events. It was also determined that annoyance depends on the level of noise, and this effect is independent of the frequency of noise events. Finally, Sorensen and Hammer (1983) find similar results when evaluating train noise. Specifically, they find that the number of noise events and the level of noise both influence the percent of residents who report that they are "very annoyed". Residents report no annoyance for less than 50 trains per 24 hour period. Above 50 trains, the level of annoyance depends on noise levels. These results are similar to a study of aircraft noise by Rylander, Björkman, Åhrlin, Sorensen and Berglund (1980). Finally, a recent study by Multer and Rapoza (1997) evaluates community impacts from wayside horns versus train horns. They found lower levels of reported annoyance for wayside horns, which were approximately 13 dB quieter than train horns. In addition, the wayside horn was found to

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have a severe impact for residents within 100 feet of the track, whereas severe impacts were found for train horns within 1000 feet of the track.

Although survey research is important in measuring attitudes towards noxious activity, stated levels of annoyance do not necessarily translate into actual economic impacts. For example, Metz (1994) shows that stated preferences on aversion to nuclear waste are inconsistent with actual behavior. That is, individuals typically report that a safe distance for storage of nuclear waste is in excess of the actual distance they live from waste. Several recent studies (Clark and Herrin, 1997, Metz and Clark, 1997; and Clark, Michelbrink, Allison and Metz, 1997) find that after controlling for the heterogeneous nature of housing both in terms of structural and neighborhood features, residential property values are detrimentally impacted by proximity to rail lines. Specifically, they find that the negative influence ranges from -1.6% to -8.9% for properties within 0.25 miles of a rail line as compared to properties at greater distances. However, these three studies did not distinguish between proximity to rail lines, and proximity to rail crossings, where whistles are blown. In addition, they did not consider the influence of whistle activity on property markets. In this study, we investigate the extent to which the action taken by Conrail to ignore whistle bans at grade crossings influenced residential property sales prices in the vicinity of railroad crossings in two different cities in Ohio.

III. Theoretical Overview of Hedonic Model

An hedonic model treats a unit of housing as a heterogeneous bundle of characteristics. These characteristics include different structural features of the housing unit (e.g., numbers of bedrooms and bathrooms, interior square footage, etc.) as well as features of the neighborhood (e.g., locational attributes such as poverty rates, racial and ethnic characteristics, average commute time, proximity to rail lines, etc.). One advantage of this modeling approach is that it allows one to examine the *ceteris paribus* influence that a particular attribute has on local housing prices. That is, holding constant the impact of structural characteristics of the home, as well as other neighborhood attributes, one can examine the independent influence of a rail crossing or a decision to ignore a ban on train whistles on the sale price of the property.

Hedonic theory, which has its foundations in the works of Lancaster (1969), Rosen (1974) and others (Freeman, 1979; Palmquist , 1984; Brown and Rosen, 1982, Diamond and Smith, 1985; Epple, 1987; and Bartik ,1987) has been extensively developed in the literature, and hence it will only be briefly reviewed here. Assuming (i) perfect information about the bundle of attributes embodied in each house, (ii) zero transactions costs in market trades of bundles, and (iii) a continuous offering of attributes, the market price of a house can be represented as p(z), where $\mathbf{z}=z_1,z_2,\ldots,z_n$ is a vector of structural and neighborhood attributes. The hedonic price function p(z) represents a reduced-form equation which embodies both supply and demand influences in the housing market. The implicit price of attribute j is then given by the partial derivative of p(z) with respect to attribute j, or $p_j(\mathbf{z})=\partial p/\partial z_j$.[2] That is, assuming the above conditions are satisfied, $p_j(\mathbf{z})$ represents the independent influence of attribute z_j on the housing price, holding constant the influence of other attributes. The equilibrium price function, p(z), is assumed to be a nonlinear function because the cost of arbitrage activity that repackages bundles of attributes once a house is built is assumed to be prohibitive. That is, the cost of reconfiguring a house (e.g., adding another bedroom) once it is built is greater than the cost that would be incurred at the time the house was built.

Applying this model to an event such as a change in train whistle policy can shed light on the impact of noxious activity on residential property markets. However, other event studies have found differential impacts over time. For example, Kiel and McClain (1994) show that the implicit price, p_j associated with an incinerator project varied as the project moved from the rumor stage to actual operation of the facility. Thus, it is possible that the influence of the policy change on train whistles has an immediate short-run effect, and smaller long-run impacts. Indeed, Galster (1986) argues that even relatively significant events such as the Three Mile Island accident may have relatively minor long term property value impacts. This is because the residents most sensitive to the presence of a nuclear power plant had long since moved from the vicinity of the plant. Those who lived in the region at the time of the accident were by definition those who were least concerned with the risks associated with the facility. The same phenomenon may be at work as we consider the influence of whistle bans. Specifically, households that are most sensitive to train noise are unlikely to live close to an established rail line. Hence, long run adjustments in the composition of local residents may serve to mitigate any property value impacts associated with the policy change. Furthermore, even though the Conrail crossings did not have whistle activity prior to October 1991, local residents may believe there to be some probability of a policy change in the future. To the extent that they consider this possibility when determining their offer price for the property, it would further diminish any measured housing price impact associated with the policy change.

IV. Empirical Model

a. Description of Model

We estimate an hedonic model using a sample of properties which sold in two counties in Ohio; Butler County in the southwestern part of the state, which contains Middletown, OH and

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[2] Rosen (1974) shows that this implicit price does not represent an individual's willingness to pay for the attribute. The implicit price can be used, however, to derive the demand for an attribute in a second stage estimation process. Brown and Rosen (1982), Diamond and Smith (1985), Epple (1987), Bartik (1987), and others, however, have noted the existence of identification problems that make estimation of these demand functions difficult. Our work need only focus on the single stage model.

Trumbull County in the northeastern OH, which contains Niles, OH. The dataset was obtained from Dataquick, and covers the period Jan. 1988 to Jan. 1997. Of the 7474 properties sold in Butler County, 4847 or 64.8% sold after the ban was ignored, whereas 61.9% of the 5416 properties in Trumbull County sold after the Conrail action. All property data are geocoded to the centroid of the zip+4 geographic area, which permits matching of the property to the salient locational attributes in the vicinity of the property.[3]

To avoid misspecification biases and mitigate problems associated with unmeasured spatially correlated influences, we control for numerous housing influences in the model. These variables can be assumed to fall into one of four broad categories; *Structural*, *Neighborhood*, *Time* Sold, and *Railroad.* A semilog specification is chosen[4], and the model is specified by equation (1).

$$\text{lnRPRICE} = f\ (\textit{Structure, Neighborhood, Time Sold, Railroad}) \qquad (1)$$

All variable definitions, data sources, and descriptive statistics are reported in Table 1. The dependent variable (lnRPRICE) is the log of real sale price of housing and is deflated by the housing component of the CPI for the month in which the property sold.

i. Categories of Independent Variables

The first category of variables, *Structure*, represents structural features of the house.

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[3]The zip+4 divides a block into four sides, with each side assigned a different zip+4 code. Thus, the less densely populated the region, the greater will be the spatial error associated with the use of zip+4 approximation. Although it would be preferable to geocode each property to the individual street address, Dataquick could not provide that level of accuracy. This creates an errors in variables problem for locational attributes in the model, which leads to biased and inconsistent ordinary least squares estimators. The size of the bias and inconsistency is related to the variance of the measurement error (Pindyck and Rubinfeld, 1991, pp. 159-161). Attempts to mitigate this problem by using more precise data from another source (i.e., Experian) proved unsuccessful since that data did not contain crucial information necessary to estimate the hedonic model (i.e., key structural features of the property). In the empirical analysis, regression models will be estimated for the densely population areas of both regions to determine whether coefficients appear to be suffering from biases related to spatial measurement error.

[4] The issue of functional form has been investigated extensively in the hedonic literature. Although some authors (Rasmussen and Zuehlke, 1990) advocate flexible functional forms, others have voiced concerns about the accuracy of implicit prices from such forms (Cassel and Mendelsohn, 1985). Cropper, Deck and McConnell (1988) argue that the semilog model is preferred when the possibility of a misspecification exists. While we have been careful in our choice of specification, such a possibility exists with spatially defined data.

Among the variables contained in this category are the number of bedrooms (BEDROOM), bathrooms (BATHROOM) and other rooms (OTHERROOM); the number of fireplaces (FIREPLACE), the age of the structure (AGEHOUSE), the size of the lot on which the structure is located (LOTAREA), and the square footage of the structure itself (BLDGAREA) and the garage (GARAGEAREA). Finally, the presence of a pool (POOL) and the number of stories (NUMSTORY) of the property area also controlled. The AGEHOUSE, BLDGAREA and GARAGEAREA variables are included in both linear and quadratic forms so as to account for potential nonmonotonicities of these variables on sale prices of housing? One would expect that structural features which increase the housing services generated by a property would increase sale price.

ii. Neighborhood and Time Trend Variables

Since the Dataquick data are geocoded, this permits the matching of a wide range of neighborhood characteristics to each property. The MapInfo PC-based GIS package is used to map each variable to the associated property. Each property is matched to a census tract, and the characteristics of that tract are then assigned to the property. Among the tract characteristics included are the percent of the houses that are occupied (%OCCUPIED), the percent of the occupied units that are owner occupied (%OWNEROCC), and the racial and ethnic mix of the tract (%BLACK, %ASIAN, and %HISPANIC). Also included in this set of demographic controls is the median household income of the tract (MEDHHINC) and the poverty rate in the census tract (%POVERTY). Finally, the median age of housing in the neighborhood (MEDYRBLT) is included to proxy the age of the neighborhood, and the average commute time within the census tract (COMMUTE) is included to account for enhancements to housing prices that result from reduced travel times. Also included is population density (POPDENSITY) which captures both amenities (e.g., variety in cultural amenities) and disamenities (e.g., congestion, noise, crime, etc.) associated with more densely populated neighborhoods. While it would be desirable to have these measures defined for each year of the sample, 1990 values must be used since they are the most recently available Census data.

Neighborhoods with relatively higher rates of occupied units, owner occupancy, and median income are expected to exhibit higher sale prices since the sample is comprised of single-

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[5] Older homes are expected to include more dated technology (e.g., some may not include central air conditioning) and hence may be less desirable. However, older homes may also include features such as hardwood floors, crown molding, etc. which are less likely found in newer homes. In addition, Palmquist (1984) has argued that building area should be included nonlinearly due to the fact that construction costs increase nonlinearly with the size of the house. Hence, we include BLDGAREA and GARAGEAREA in linear and quadratic form. Overall, linear terms for the age and area variables are expected to have a positive influence on sale prices, and the quadratic terms are expected to negatively impact prices.

family homes. On the other hand, higher rates of poverty should lower prices because of negative neighborhood externalities associated with high poverty rates. In addition, the urban location model predicts that lower commute times should result in higher sale prices, *ceteris paribus*. Finally, the expected impact of the racial and ethnic variables is unknown *a priori* since the race/ethnicity of the buyers, which may proxy individual preferences, are unknown.

We also use GIS tools to determine how close each property is to various types of noxious activity. Specifically, we examine noxious activity related to proximity to interstate highways (HWY) and airports (AIRPT). Since a primary goal of this study is to measure the influence of noise on residential property markets, we measure the airport gradient for distances of up to 3 miles from the airport and distances up to 1/4 mile for highways. Noise levels outside these ranges are assumed to be too low to influence property markets. Since the geocoded airport distance is measured from the center of the runways, we must account for the airport area. We assume that the property that is closest to the airport is at the edge of the airport. Thus, to derive a 3 mile buffer around the fringe of the airport area, we include properties within 3.3 miles of the center of the runway for Butler County (since the closest property is 0.3 miles in that sample), and we include properties within 3.8 miles of the. center of the runway for Trumbull County (since the closest property is 0.8 miles in that sample). Activity levels at the airport are not controlled since there is only one airport in each of the two regions, and hence activity levels at the airport do not vary within each county. Air quality in the neighborhood (OZONE) is proxied by the reading at the closest ozone monitor. Since ground-level ozone monitors are not uniformly dispersed throughout metropolitan areas, but rather are placed in areas which are more likely to have higher ozone levels, we construct a distance weighted value for ozone which is the reading from the closest monitor divided by the distance from that monitor. Proximity to hazardous materials is proxied by the presence of Superfund sites within a 3 mile radius of each property (SUPERFUND)[6], and the presence of manufacturing facilities on the Toxic Release Inventory within a 1 mile radius (TOXRELINV). Finally, we include proximity (i.e., within 1 mile) to power plants (POWERPLANT) to proxy emissions associated with these facilities. Two other factors that roughly fall into this category of noxious activity variables are hazardous waste treatment facilities, and proximity to a correctional facility. However, neither of these facilities were found within 2 miles of any property in either sample. Overall, one would expect proximity to noxious activity to reduce the sale price of the property.

Next, proximity to streams, lakes and rivers (LAKERIVER) is included to proxy access to aesthetic and recreational amenities. We include the property tax rate for the residence (TAXRATE) to measure the local property tax burden and dummy variables for the school district (SCHOOLD) to account for housing price differentials related to variations in school quality. The data set also contains information about the political jurisdiction in which each dwelling lies. To account for amenities and disamenities as well as public services associated

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[6] A three mile impact zone is used by the EPA in evaluating some Superfund sites.

with the jurisdiction, dummy variables for the political jurisdiction are included.

Variables in the *Time Sold* category include dummy variables for the year in which the property sold. This should control for the influence of long run trends in housing prices, as well as factors related to the business cycle. The omitted year is 1988. In addition, seasonal dummy variables are included to account for whether the property was sold in the spring, summer, fall or winter, with winter being the left-out dummy variable. There are no sign expectations in any of the time related variables since both supply and demand for housing change during each period.

To account for the influence of railroad noise, we include several different measures in the *Railroad* category. To account for whistle noise, we measure the distance of the property to the closest rail crossing. Conrail crossings are distinguished from other crossing data. Note that since railroads do not share lines in any of the areas studied, and since activity levels are roughly 'constant for the period being considered, activity levels for Conrail crossings within each county do not vary. The same is true for other crossings. The potential impact area for each crossing is defined as ½ mile from the crossing. We arrive at this approximation based on findings in the literature. Multer and Rapoza (1997) report that locomotive engineers begin sounding their horn approximately 1326 feet (i.e., ¼ mile) from the highway-railroad grade crossing. In addition, they report that the impact or severe impact zone for train whistles is at most, 1000 feet from the track. Given potential errors introduced by geocoding to the zip+4 address, we adopt a conservative approach to defining the potential audible range, and add an additional 500 feet to the total to generate an outer limit to the potential impact zone of 2826 feet (i.e., 1326+1500). This is slightly more than ½ miles from the rail crossing.[7] In general, homes in the Niles sample are further from rail crossings than Middletown. Specifically, approximately 17.9% of the properties fall within 2826 feet of Conrail crossings in Niles, and 37.8% are within that distance of Conrail crossings in Middletown. Likewise, the properties in Middletown are closer to crossings of other rail companies on average than Niles (i.e., 14.5% are within the 2826 feet for Niles, and 29.1% are within that distance for Middletown). Noise and vibration which are unrelated to whistle noise are measured by the number of railroads within a ¼ mile buffer area around each property. It is assumed that noise and vibration which is unrelated to whistle noise will dissipate within ¼ mile.

Two different specifications are examined for each of the two geographic regions. In the first specification, a distance gradient (measured as the distance from the crossing within the potential impact zone) is derived. The distance from the crossing is interacted with a dummy variable representing whether the sale took place after Conrail began ignoring the whistle ban to allow for different slopes of the gradient in the period before and after the Conrail decision. The results for the first specification are reported in Table 2. The second specification also interacts

[7] A slight coding error resulted in the use of 2820 feet as opposed to 2826 feet. The impact on the final results was negligible.

the gradient with the number of days since the date that Conrail began ignoring the ban to measure whether the action has diminishing effects on residential property markets over time. Given the findings of other event studies (Kiel and McClain, 1994), one would expect that short-run effects are more pronounced than the eventual long run-impacts. The results for the second specification are reported in Table 3.

d. Empirical Findings

The empirical findings are reported in Tables 2 and 3. The White test revealed evidence of heteroskedasticity, and White's correction technique is used to generate consistent estimates of standard errors. Before discussing the findings on the railroad variables, the results on the control variables are described. Since the coefficients and the t-scores on control variables differ very little between the equations in Tables 2 and 3, they are discussed for the results in Table 2 only.

Structural Variables

The age of the house has a significant negative influence on residential home prices in Middletown, with the quadratic coefficient negative but insignificant. For Niles, the linear coefficient on house age is positive (although insignificant) whereas the quadratic term is negative and significant. Treating the coefficients as point estimates, housing values rise in Niles for the first 13.7 years, and then fall thereafter. Additional bedrooms, bathrooms and other rooms increase housing values in both samples, with the strongest impact from an additional full bathrooms (3.8% in Middletown, and 8.1% in Niles. Interestingly, the coefficients on rooms in the Niles area are about twice the magnitude of the corresponding coefficients in Middletown sample. The presence of a fireplace significantly increases the home sale price by approximately 13% in both samples. This is likely serving as a proxy for other qualitative features of a home in addition to the influence of the fireplace. For example, fireplaces may be more likely to be found in homes with family rooms. Indeed, this finding is consistent with that found in other hedonic models (e.g., Clark, Michelbrink, Allison and Metz, 1997). Each additional story reduces the real sale price by about 4% in Niles, and about 1.5% in Middletown, although the latter coefficient is not significant at the 95% level of confidence. The presence of a swimming pool significantly raises the sale price of the property by about 9% in both samples. Turning to the square footage measures, additional building area increases value at a decreasing rate, which is consistent with Palmquist (1984). Evaluating this at the mean building area value in each sample (i.e., 1404 sq.ft. in Middletown, and 1495 sq.ft. in Niles), an increment of 100 square feet increases housing value by 2.8% in Middletown, and 2.5% in Niles. Additional garage area also increases values at a decreasing rate with each 100 square foot increment in garage space leading to an increase in value of 1.3% in Middletown and 3.7% in Niles (again, these are evaluated at the mean values for garage area). This higher impact of garage space in Niles is due to stronger marginal effects resulting from the magnitude of the coefficients in the Niles regression, combined with garage sizes that are on average about 30% larger in Niles. Finally, the size of the lot significantly increases the sale price of the housing unit by approximately 2% per acre in the Middletown area, whereas the coefficient is statistically insignificant in the Niles area. In both locations, average lot size is approximately ½ acre.

Neighborhood Characteristics

The influence of neighborhood characteristics varies between locations, and the coefficients are sometimes counterintuitive, suggesting that the variable may be capturing more than just the influence of the variable in question. For example, the influence of the air quality measure is positive in both equations, and significant at the 90% level of confidence or higher. To capture the influence of airport noise, two variables are included. A dummy variable set equal to one if the property is within 3 miles of the airport is included separately, and it is also interacted with distance from the airport to allow for stronger impacts associated with closer proximity to the airport. It is assumed that airport impacts will be zero beyond the 3 mile zone. For the Middletown regression, both coefficients suggest that on net, proximity to the airport is seen as desirable. The coefficient on the three mile dummy variable is positive and significant implying that other things equal, housing prices are approximately 15% higher for properties within 3 miles of the airport, as compared to those outside that range. In addition, housing prices fall by approximately 5% per mile with distance from the airport. This suggests that employment opportunities associated with proximity to the airport overwhelm any negative impacts resulting from higher noise levels near the airport. The opposite is true for properties selling near the airport in Niles. Home sales prices are nearly 37% lower in the 3 mile buffer area, and they rise by about 11% per mile further away from the airport. Although it is possible that this is capturing primarily the influence of noise, it is likely capturing other influences as well. This may include traffic congestion, industrial activity, etc.

Turning to the neighborhood measures drawn from 1990 census tract data, it is not surprisingly to find that real housing prices are higher in more affluent neighborhoods, and in neighborhoods with lower poverty rates, although the latter is not significant in the Niles model. Older neighborhoods, as determined by a smaller value for MEDYRBLT, have significantly lower priced housing in Middletown, and relatively higher priced housing in Niles. Surprisingly, a high percent of occupied units significantly decreases the sale price of housing in Middletown although it should be noted that there is very little variation in this variable, and most neighborhoods have high occupancy rates. This may be capturing the influence of desirable neighborhoods that are experiencing active construction activity. Likewise, whereas an increase in the percent of occupied homes that are owner-occupied raises housing prices in Middletown, it actually has the opposite effect in Niles. Population density, which can proxy both amenities and disamenities associated with a neighborhood, on net has a negative and significant influence on housing prices in the Niles regression model. The racial and ethnic mix of the neighborhood exerts a statistically important influence on both housing markets. Specifically, increases in the Black population, and decreases in the Hispanic population both decrease housing prices in the Middletown region. In contrast, higher concentrations of Asian and Hispanic populations lead to lower real housing prices in Niles. It should be noted however that concentrations of all minority groups are low on average, with mean Hispanic and Asian concentrations less than 1%. Finally, consistent with the predictions of the urban location model (e.g., Bender and Hwang, 1985), higher average commuting times reduce the real home price, with the coefficient significant at the 90% level of confidence in the Middletown equation. An increase in commuting time of 10 minutes depresses housing prices almost 6% in that neighborhood.

The school district exerts a relatively strong influence on real home prices. For example, housing price difference are as large as 25% between the lowest and the highest valued school districts in Middletown, and they swing more than 60% in Niles county. A high property tax burden depresses housing prices in Niles. Specifically, a 1% increase in the tax rate leads to a 3.2% reduction in the sale price of the property. Finally, the dummy variables for the jurisdiction in the Middletown model are individually significant, whereas they are individually insignificant in the Niles model.

Proximity to a non-nuclear power generating plant increases property values in the Middletown sample by almost 54%, again suggesting that this variable is picking up other influences over and above either employment effects associated with the plant, or negative environmental attributes from production at the plant. Indeed, the variable is positive, but much smaller in magnitude (with a t-score in the 1.5 range) in the Niles regression model. Proximity to a chemical manufacturing facility on the toxic release inventory in Niles, and proximity to a Superfund site in Middletown depresses property values, although neither are significant at conventional confidence levels.

Time and Seasonal Dummy Variables

Seasonal dummy variables show that housing prices in Middletown are significantly higher in the fall, than the winter (the left-out category) whereas they are significantly lower during the spring in Niles. In addition, real housing prices have risen over the 1988-1997 time period, with the real appreciation rate approximately 28% in Middletown, and 35% in Niles. The influence of the mild recession in 1990-91 is indicated by a slight decline in real housing prices (i.e., -1.9%) between 1990 and 1991 in Middletown and insignificant changes in 1989 and 1990 (as compared to 1988) in Niles.

Railroad Related Variables

To investigate the influence of whistle bans in Middletown and Niles, we introduce three sets of variables. First, to control for the influence of rail activity unrelated to the blowing of whistles, we determine the number of rail lines that are within ¼ mile of the property. It is assumed that nonwhistle noise dissipates beyond that range. In both cities, an additional railroad within ¼ mile significantly reduces the real sale price, with the reduction in value approximately 2.1% in Middletown, and approximately 2.7% in Niles. Second, since some of the grade crossings are for lines other than Conrail which continue to honor the ban, we distinguish between Conrail crossings, and those of other lines. For other lines, we include a dummy variable for the expected audible range (i.e., 2820 feet as described above) should the rail company decide to begin ignoring the ban, and also a distance calculation to the intersection interacted with the dummy variable for the audible range. For Middletown, housing prices are approximately 7.8% lower within the 2820 radius, and they significantly rise by about 2.5% per 1000 feet (or 7.1% total for the 2820 range) with additional distance from the crossing. Thus, even though rail companies are not currently blowing their whistles at these grade crossings, home buyers apparently believe that the possibility exists for a change in such policy, and offer lower prices for homes in the proximity of these crossings. Third, the Conrail crossings are modeled using three variables; a. the dummy variable for the 2820 feet audible range, b. the distance of the property to the Conrail crossing interacted with the dummy variable for the audible range', and c. distance interacted with the audible range and second dummy variable reflecting the Conrail decision to ignore the ban. In both cities, real housing prices are lower within the audible range with the coefficient on the dummy variable reflecting 6.2% lower prices in Middletown, and 17.9% lower in Niles. The coefficient on the distance variable interacted with the audible range is negative and insignificant in the Middletown area (t=-0.19), and it is positive and insignificant although it approaches significance at the conventional levels in a 1-tailed test (t=1.49; prob. value of p=0.075) in the Niles area. Thus, for Niles, housing values increase by almost 13% within the audible range. Finally, the third variable which interacts the distance within the audible range with the dummy variable for ignoring the ban reveals that the action by Conrail has no influence in the Niles area (t=0.74), but it is significant in a l-tailed test (t=1.68; prob. value of p=0.045) in the Middletown regression model. This implies that the rate at which housing prices rise with distance, increases by about 1.6% per 1000 feet (or 4.5% from the closest point next to the crossing, to the edge of the audible range) in the period after the ban was ignored.

Finally, we investigate whether the influence on housing prices from ignoring the ban is temporary. That is, is the largest impact of the Conrail action, felt directly after the ban is ignored, followed by a declining influence. To investigate this possibility, a fourth variable is introduced to the hedonic regression. This variable is the distance from the crossing, times the dummy variable for the audible range, times the dummy variable for ignoring the ban, times the number of days that have passed since the ban was ignored. The interpretation of this coefficient

[8] To gain some insight as to whether distance from the crossing matters, a regression was run which included dummy variables for each 100 feet from the crossing for the range 0-100 feet through 2800-2900 feet. The findings, which are reported in Appendix A, suggest that property prices are significantly lower within 500 feet of the crossing than those property prices at more distant locations within the potential audible range. To simplify the specification, we focus on a continuous distance gradient by including distance from the rail crossing for the potential audible range rather than 29 separate dummy variables.

requires some care. If the immediate impact is reduced over time, then one would expect that the coefficient on this variable would be negative, since the positive premium resulting from greater distances from the crossing after the ban was ignored would decline as the number of days after the action took place increases. These regression results are reported in Table 3. Since the coefficients on non-railroad variables are nearly identical in magnitude and significance levels, we focus on the railroad related variables only.

An examination of the findings for the Middletown regression suggest that the finding of a significant impact associated with ignoring the whistle ban is not robust. Specifically, the coefficient on whistle ban variable becomes insignificant when this additional variable is introduced. Furthermore, after accounting for the days since the ban was ignored, it was found that the coefficient on that interaction term was actually positive with a t-score of 1.49. This implies that the gradient increases in slope by approximately 0.4% per 1000 feet from the crossing, per year. While this finding might be interpreted as providing weak evidence of increased aversion to the crossing after the ban was ignored (note the variable is insignificant in a 2-tailed test), it is not consistent with the expectation that short run impacts would exceed those in the long run. On the contrary, the impacts appear to grow over time. This is clearly inconsistent with the findings of short run vs. long run effects in other hedonic studies (e.g., Kiel and McClain, 1994; Galster, 1986). Finally, the coefficients on NUMRRLINES, and the other crossing variables are nearly identical to those reported in Table 2 for the Middletown regression.

Turning to the Niles regression, the coefficient on the distance coefficient within the audible range is positive, and although its significance level is still below standard levels (i.e., it is not significant at the 95% level of confidence), it is correctly signed and hence the significance level can be evaluated in a l-tailed test (t=1.43, prob. value p=0.075). The findings suggest that housing prices rise 4.4% per 1000 feet from the crossing or 12.2% total from the closest property to the edge of the audible range. In addition, ignoring the ban increased the premium per 1000 feet by 3.4% (or an additional 9.6% from the crossing to the edge of the audible range). The premium for increased distance from the Conrail crossing does appear to be temporary, falling approximately 1.7% per 1000 feet per year (or an additional 4.8% from the closest property to the edge of the audible range per year). This implies that the premium for distance disappears within about 4.5 years (i.e., (12.2%+9.6%)/4.8% = 4.54 years). Finally, as was the case with the Middletown regression, the railroad variables that are not related to Conrail crossings are also robust to the addition of interaction term that allows comparison of short run and long run effects.

Sensitivity to Spatial Density

To ascertain whether spatial errors associated with the use of zip+4 geocoding of properties are important, the regressions in Tables 2 and 3 are re-estimated on a subset of the original sample. Specifically, properties in census tracts which include less than 500 persons per square mile are omitted, which yields a sample of 4037 properties in Middletown (54% of original sample) and 3 161 properties in Niles (58% of original sample). Signs and significance levels on the control variables are similar for most variables, although the coefficients on some variables do change in magnitude. We focus our attention on the *Railroad Related Variables* category. Table 4a contains the findings on coefficients similar to the specification in Table 2, and Table 4b contains the findings on coefficients similar to Table 3.[9] From Table 4a, it can be seen that most of the variables that are significant for the broader sample, remain significant when the sample is reduced to include only properties in densely populated areas. The only notable exception is the coefficient on $XGR_{CONRAIL}$*IGNORE in the Middletown area. In Table 2, that coefficient is positive and significant in a one-tailed test, which indicates an increased premium resulting from distance from Conrail crossings after the Conrail action. In Table 4a, the coefficient on $XGR_{CONRAIL}$*IGNORE remains positive albeit of smaller magnitude, but it is no longer statistically significant. In addition, the coefficients on the dummy variables for the potential audible range are generally more negative when the regression is restricted to properties within the more densely populated neighborhoods. Finally, the influence of proximity to rail lines as compared to the full sample, varies between Middletown and Niles. While the coefficients on NUMRRLINES remain negative and significant, the magnitude of the influence for the more densely populated areas is higher in Niles for the more densely populated sample, whereas it is lower for Middletown.

Turning to Table 4b, the same general patterns emerge for short-run and long-run impacts for properties selling in the Niles, OH regression. That is, similar to Table 3, there is an increased premium for distance from Conrail crossings, after the Conrail decision to ignore the whistle ban (i.e., the coefficient on $XGR_{CONRAIL}$*IGNORE is positive) but it is a short-run impact only (i.e., the coefficient on $XGR_{CONRAIL}$*DAYS is negative). Moreover, the negative impact appears to be temporary, disappearing completely after 3.15 years.

V. Conclusions and Policy Implications.

These findings provide only weak evidence of negative impacts on residential property markets resulting from the policy action taken by Conrail in October, 1991. Certainly properties which sell within the potential audible range around a rail crossing (both for Conrail and other rail companies) sell at lower prices than comparable properties outside that range. Likewise, proximity to an additional rail line, holding proximity to crossings constant, also has a detrimental influence on property prices. All of these impacts existed prior to the point at which Conrail

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[9] Note that the specifications are not identical, since some variables for the wider sample, become constants when the sample is restricted to having higher population density. Specifically, for the Middletown sample, most of the school district dummy variables, the power plant dummy, and the highway gradient measures do not vary. In addition, all the properties are within Middletown proper. For the Niles sample, several school district dummy variables must be omitted, and one of the city dummy variables is dropped to avoid matrix singularity.

began ignoring the train whistle bans in Middletown, OH and Niles, OH. The evidence in Middletown implies that housing prices rise by approximately 1.6% per 1000 feet from the crossing after Conrail began ignoring the ban. Furthermore, once differential short and long run impacts of the policy change are included, the findings are also insignificant. Indeed, they suggest that either the short run impacts are amplified over time (as is implied by Table 3) or that there is no distinction between short run and long run influences (and hence the results in Table 2 are more appropriate). Neither alternative is consistent with our understanding of the dynamics of real estate markets in response to increased hazards, or noxious activity in the neighborhood. Finally, the findings reported in Table 4a indicate that the permanent impact implied by Table 2 does not hold up when the sample is restricted to more densely populated neighborhoods.

The evidence in Niles is stronger, and it points to short run impacts from the policy change. Specifically, the Conrail action on the whistle ban initially causes housing prices to fall with decreased distance from the Conrail crossing., However, over time, the detrimental impact of the action declines, and it disappears completely after 3.1-4.5 years depending on whether the full sample, or the densely populated subsample is used. That the impact of the Conrail policy action has minor and only temporary impacts on real housing prices is not necessarily surprising. Individuals buying properties within the potential audible range of a rail crossing likely consider at least the possibility that train whistle will be blown at the crossing in the future. Thus, when Conrail began ignoring the ban, it was only confirming their initial suspicions. Furthermore, it is likely that the individuals most sensitive to the train whistle noise eventually moved from the audible range, and were replaced with those less concerned with the activity. This transition does not happen immediately. However, within 3.1 to 4.5 years, the negative impact of the Conrail action was eliminated.

These findings, while enlightening, are just a first step in understanding how train whistles influence local property markets. Surveys of train noise suggest that in addition to proximity, frequency and timing of trains are also important determinants of annoyance levels. Extensions of this work should focus on incorporating a more complete picture of the level of train activity on residential property markets. These differences may help to account for the differences between the findings in Niles and in Middletown. Another extension would be to investigate wider geographic area than just the two sites in Ohio. One could then determine whether residents in certain parts of the country are more or less sensitive to whistle noise. In principle, if enough cities were investigated, it would be possible to determine how demographic factors such as neighborhood income levels, race and ethnicity, etc. influence the impact of train whistle noise. Finally, future work should attempt to further reduce biases associated with less precise geocoding techniques. Although the bias associated with geocoding to the zip+4 centroid is expected to be small, future matching should geocode to the precise street address.

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Table 1
Variable Name and Definition, Data Source, Descriptive Statistics and Predicted Sign

Dependent Variable and Variables in the *Structural* Category

Variable Name	Definition [mean, standard deviation] $N_{MIDDLETOWN}$=7474, N_{NILES}=5416	Source	Predicted Sign
RPRICE	Real sale price of the property (1990 dollars) [$\mu_{MIDDLETOWN}$ =68164.5, $\sigma_{MIDDLETOWN}$=36976.7] [μ_{NILES}=58578.17, σ_{NILES}=36897.41]	Dataquick nominal price divided by the national CPI for housing	lnRPRICE is the dependent variable
AGEHOUSE, AGESQ	Age of the house in years, age squared. Descriptive statistics for AGEHOUSE only. [$\mu_{MIDDLETOWN}$ =41.38, $\sigma_{MIDDLETOWN}$=27.79] [μ_{NILES}=38.192, σ_{NILES}=24.766]	Dataquick	?
BATHROOMS	Sum of full and half baths, where each full bath=1 and each half bath=0.5. [$\mu_{MIDDLETOWN}$ =1.527, $\sigma_{MIDDLETOWN}$=0.640] [μ_{NILES}=1.484, σ_{NILES}=0.602]	Dataquick	+
BEDROOM	Number of bedrooms in house [$\mu_{MIDDLETOWN}$ =2.901, $\sigma_{MIDDLETOWN}$=0.703] [μ_{NILES}=3.011, σ_{NILES}=0.631]	Dataquick	+
OTHRROOM	Total rooms minus number of bedrooms [$\mu_{MIDDLETOWN}$ =3.087, $\sigma_{MIDDLETOWN}$=0.990] [μ_{NILES}=3.079, σ_{NILES}=0.892]	Dataquick	+
FIREPLACE	Number of fireplaces in the house [$\mu_{MIDDLETOWN}$ =0.499, $\sigma_{MIDDLETOWN}$=0.472] [μ_{NILES}=0.323, σ_{NILES}=0.468]	Dataquick	+
NUMSTORY	Number of stories in the property [$\mu_{MIDDLETOWN}$ =1.371, $\sigma_{MIDDLETOWN}$=0.506] [μ_{NILES}=1.585, σ_{NILES}=0.528]	Dataquick	?
POOL	1=Presence of a pool, 0=otherwise. [$\mu_{MIDDLETOWN}$ =0.022, $\sigma_{MIDDLETOWN}$=0.146] [μ_{NILES}=0.085, σ_{NILES}=0.278]	Dataquick	?

Variable Name	Definition [mean, standard deviation] $N_{MIDDLETOWN}$=7474, N_{NILES}=5416	Source	Predicted Sign
BLDGAREA BLDGAREASQ	Structure area in square feet, and area squared. Descriptive statistics for BLDGAREA only. [$\mu_{MIDDLETOWN}$ =1404.488, $\sigma_{MIDDLETOWN}$=567.555] [μ_{NILES}=1494.815, σ_{NILES}=597.708]	Dataquick	+
GARAGEAREA GARAGEARESQ	Garage area in square feet, garage area squared. Descriptive statistics for GARAGEAREA only. [$\mu_{MIDDLETOWN}$ =268.373, $\sigma_{MIDDLETOWN}$=247.195] [μ_{NILES}=349.340, σ_{NILES}=240.114]	Dataquick	+
LOTAREA LOTAREASQ	Lot area in square feet, lot area squared Descriptive statistics for LOTAREA [$\mu_{MIDDLETOWN}$=208 15.40, $\sigma_{MIDDLETOWN}$=53 840.99] [μ_{NILES}=21796.22, σ_{NILES}=79094.99]	Dataquick	+

Variables in the ***Neighborhood*** Category

Variable Name	Definition [mean, standard deviation]	Source	Predicted Sign
OZONE	Distance weighted value of the nearest ozone monitor, computed as ozone concentration/ distance of monitor to property [μ=2.42, σ=2.35][$\mu_{MIDDLETOWN}$ =, $\sigma_{MIDDLETOWN}$=] [μ_{NILES}=, σ_{NILES}=]	EPA-AIRS AQS database	
AIRPT3MI AIRPTGRADIENT	AIRPT3MI=1 if property within 3 miles of edge of airport. Note, edge of airport defined by closest sold property from airport, 0=otherwise. [μ_{NILES}=, σ_{NILES}=] AIRPTGRADIENT defined as distance of airport from the property times AIRPRT3MI. [μ_{NILES}=, σ_{NILES}=]	FAA, MapInfo computed.	

Variable Name	Definition [mean, standard deviation]	Source	Predicted Sign
HWYQUARTERMI	HWYQUARTERMI= 1 if property within quarter mile of property, 0=otherwise. HWYGRADIENT defined as distance of highway from property times HWYQUARTERMI	MapInfo computed	
LAKERIVR	1=lake, river- or stream within 0.25 miles of the property, 0 otherwise. [$\mu_{MIDDLETOWN}$ =0.280, $\sigma_{MIDDLETOWN}$=0.449] [μ_{NILES}=0.153, σ_{NILES}=0.360]	MapInfo computed	
MEDHHINC	Median household income of the census tract [$\mu_{MIDDLETOWN}$ =32831.00, $\sigma_{MIDDLETOWN}$=11197.69] [μ_{NILES}=31211.51, σ_{NILES}=8459.280]	Census STF-3A	+
MEDYRBLT	Median year the houses in the census tract were built. [$\mu_{MIDDLETOWN}$ =1960.016, $\sigma_{MIDDLETOWN}$=11.754] [μ_{NILES}=1959.218, σ_{NILES}=8.508]		
%ASIAN	Percent of census tract populationthat is Asian or pacific islander. [$\mu_{MIDDLETOWN}$ =0.270, $\sigma_{MIDDLETOWN}$=0.443] [μ_{NILES}=0.802, σ_{NILES}=0.967]	Census STF-3A	?
%BLACK	Percent of census tract population that is black. [$\mu_{MIDDLETOWN}$ =4.565, $\sigma_{MIDDLETOWN}$=11.741] [μ_{NILES}=3.383, σ_{NILES}=8.836]	Census STF-3A	?
%HISPANIC	Percent of census tract population that is Hispanic [$\mu_{MIDDLETOWN}$ =0.475, $\sigma_{MIDDLETOWN}$=0.459] [μ_{NILES}=0.741, σ_{NILES}=0.326]	Census STF-3A	?
%OCCUPIED	Percent of census tract housing units that are occupied. [$\mu_{MIDDLETOWN}$ =95.880, $\sigma_{MIDDLETOWN}$=2.019] [μ_{NILES}=95.988, σ_{NILES}=1.610]	Census STF-3A	+
%OWNEROCC	Percent of census tract housing units that are owner-occupied. [$\mu_{MIDDLETOWN}$ =72.028, $\sigma_{MIDDLETOWN}$=16.957] [μ_{NILES}=76.036, σ_{NILES}=11.002]	Census STF-3A	+

Variable Name	Definition [mean, standard deviation]	Source	Predicted Sign
%POVERTY	Percent of census tract population that is below the poverty line. [$\mu_{MIDDLETOWN}$ =10.079, $\sigma_{MIDDLETOWN}$=9.264] [μ_{NILES}=9.715, σ_{NILES}=6.536]	Census STF-3A	
POPDENSITY	Population density in the census tract, measured as people per square mile. [$\mu_{MIDDLETOWN}$ =652.072, $\sigma_{MIDDLETOWN}$=569.078] [μ_{NILES}=495.190, σ_{NILES}=295.380]	Census STF-3A	?
SUPERFUND	1=at least 1 site which is on the National Priorities List (i.e., Superfund List) within 3 miles of the property, 0=otherwise. ***Note: Niles has no properties within 3 miles of a Superfund site.*** [$\mu_{MIDDLETOWN}$ =0.012, $\sigma_{MIDDLETOWN}$=0.110]	Landview	II -
TAXRATE	tax payment /assessed value. [$\mu_{MIDDLETOWN}$ =4.040, $\sigma_{MIDDLETOWN}$=0.466] [μ_{NILES}=4.206, σ_{NILES}=0.844]	Dataquick	
TOXRELINV	1= at least 1 manufacturing facility which are on the Toxic Release Inventory within 1 mile of the property, 0=otherwise [$\mu_{MIDDLETOWN}$ =0.505, $\sigma_{MIDDLETOWN}$=0.500] [μ_{NILES}=0.359, σ_{NILES}=480]	Landview	II -
COMMUTETIME	Average household travel time to work in the census tract in minutes. [$\mu_{MIDDLETOWN}$ =21.416, $\sigma_{MIDDLETOWN}$=2.428] [μ_{NILES}=19.417, σ_{NILES}=1.595]	Census STF-3A	
POWERPLANT	1=presence of power plant within 1 mile of property, 0=otherwise. [$\mu_{MIDDLETOWN}$ =0.001, $\sigma_{MIDDLETOWN}$=0.036] [μ_{NILES}=0.037, σ_{NILES}=0.190]	MapInfo computed	?

Variable Name	Definition [mean, standard deviation]	Source	Predicted Sign
School Dummy variables	1=dwelling lies with school district i (where i=8 for Middletown, and i=13 for Niles), 0=otherwise. ***Mean values reported.*** [$\mu_{MIDDLETOWN,1}$=0.001, $\mu_{MIDDLETOWN,2}$=0.727, $\mu_{MIDDLETOWN,3}$=0.089, $\mu_{MIDDLETOWN,4}$=0.0002, $\mu_{MIDDLETOWN,5}$=0.100, $\mu_{MIDDLETOWN.}$ =0.080, $\mu_{MIDDLETOWN,7}$=0.001, $\mu_{MIDDLETOWN,8}$ =0.001] [$\mu_{NILES,1}$=0.151, $\mu_{NILES,2}$=0.240, $\mu_{NILES,3}$=0.087, $\mu_{NILES,4}$=0.017, $\mu_{NILES,5}$=0.006, $\mu_{NILES,6}$=0.298, $\mu_{NILES,7}$=0.012, $\mu_{NILES,8}$ =0.045, $\mu_{NILES,9}$=0.027, $\mu_{NILES,10}$=0.055,$\mu_{NILES,11}$=0.0004, $\mu_{NILES,12}$=0.014, $\mu_{NILES,13}$=0.041]	Wessex	? Left out category is largest school district.
City Dummy variables	1 =dwelling lies within specific city political boundaries, 0 otherwise. ***Mean values reported.*** For Middletown, jurisdictions are Monroe, Trenton and Middletown. [$\mu_{MIDDLETOWN}$=0.844, μ_{MONROE}=0.068 $\mu_{TRENTON}$=0.088] For Niles, jurisdictions are Girard, Niles, Mineral Ridge, McDonald and Warren. [μ_{GIRARD}=0.196 μ_{NILES}=0.270 $\mu_{MINERAL\ RIDGE}$=0.033 $\mu_{MCDONALD}$=0.061 μ_{WARREN}=0.440]	Dataquick	? Left out category in Middletown is Middletown and left out category in Niles is Warren.

Time Related Variables

Variable Name	Definition [mean values] $N_{MIDDLETOWN}$ =7474, N_{NILES}=5416	Source	Predicted Sign
Seasonal Dummy variables	***Mean values only*** Spring= 1 (March-May), 0=otherwise [$\mu_{MIDDLETOWN}$ =0.282, μ_{NILES}=0.275] Summer= 1 (June-Aug), 0=otherwise [$\mu_{MIDDLETOWN}$ =0.294, μ_{NILES}=0.303] Fall= 1 (Sept-Nov), 0=otherwise [$\mu_{MIDDLETOWN}$ =0.237, μ_{NILES}=0.235] Winter= 1 (Dec-Feb), 0=otherwise [$\mu_{MIDDLETOWN}$ =0.187, μ_{NILES}=0.187]	Dataquick	Spring ? Summer ? Fall ? Winter is left out variable
YEARi (i=1988,...,1997)	***Mean values only*** 1=dwelling sold in i^{th} year, 0 otherwise [$\mu_{MIDDLETOWN,88}$ =0.084, $\mu_{MIDDLETOWN,89}$ =0.084, $\mu_{MIDDLETOWN,90}$ =0.096, $\mu_{MIDDLETOWN,91}$ =0.096, $\mu_{MIDDLETOWN,92}$ =0.103, $\mu_{MIDDLETOWN,93}$= 0.116, $\mu_{MIDDLETOWN,94}$ =0.101, $\mu_{MIDDLETOWN,95}$ =0.118, $\mu_{MIDDLETOWN,96}$ =0.123, $\mu_{MIDDLETOWN,97}$ =0.079] [$\mu_{NILES,88}$=0.097, $\mu_{NILES,89}$=0.094, $\mu_{NILES,90}$=0.103, $\mu_{NILES,91}$=0.098, $\mu_{NILES,92}$=0.117, $\mu_{NILES,93}$=0.139, $\mu_{NILES,94}$=0.134, $\mu_{NILES,95}$=0.132, $\mu_{NILES,96}$=0.078, $\mu_{NILES,97}$=0.007]	Dataquick	? 1988 is left out variable

Variables in the ***Railroad*** Category

Variable Name	Definition [mean, standard deviation] $N_{MIDDLETOWN}$ =7474, N_{NILES}=5416	Source	Predicted Sign
$XWITHIN2820_{CONRAIL}$ $XWITHIN2820_{OTHER}$	1=0 Conrail rail crossing within 2820 feet (i.e., potential audible range) of the property, 0=otherwise. [$\mu_{MIDDLETOWN}$ =0.377, $\sigma_{MIDDLETOWN}$ =0.485] [μ_{NILES}=0.178, σ_{NILES}=0.382] 1=0 other rail crossing within 2820 feet of the property, 0=otherwise. [$\mu_{MIDDLETOWN}$ =0.290, $\sigma_{MIDDLETOWN}$=0.454] [μ_{NILES}=0.144, σ_{NILES}=0.351]	Computed from FRA crossing database.	

Variable Name	Definition [mean, standard deviation] $N_{MIDDLETOWN}=7474$, $N_{NILES}=5416$	Source	Predicted Sign
$XGRADIENT_{CONRAIL}$ $XGRADIENT_{OTHER}$	Distance of the property from Conrail crossing*$XWITHIN2820_{CONRAIL}$. [$\mu_{MIDDLETOWN}=594.320, \sigma_{MIDDLETOWN}=863.209$] [$\mu_{NILES}=312.414, \sigma_{NILES}=731.973$] Distance of the property from other crossing*$XWITHIN2820_{OTHER}$. [$\mu_{MIDDLETOWN}=460.104, \sigma_{MIDDLETOWN}=816.701$] [$\mu_{NILES}=255.222, \sigma_{NILES}=673.470$]	Computed from FRA database	+
$XCR_{CONRAIL}$*IGNORE	$XGRADIENT_{CONRAIL}$*IGNORE where IGNORE defined as follows: 1=property sold more than 45 days after the decision by Conrail to ignore the whistle ban, 0=otherwise. [$\mu_{MIDDLETOWN}=395.786, \sigma_{MIDDLETOWN}=757.222$] [$\mu_{NILES}=200.850, \sigma_{NILES}=602.559$]	Computed from FRA database	+
$XCR_{CONRAIL}$*DAYS	$XGRADIENT_{CONRAIL}$*IGNORE*DAYS where DAYS defined as number of days since the ban was ignored. [$\mu_{MIDDLETOWN}=423868.9$, $\sigma_{MIDDLETOWN}=953578.9$] [$\mu_{NILES}=191378.2$, $\sigma_{NILES}=648434.9$]	Computed from FRA database	
NUMRRLINES	Number of railroad lines within 0.25 miles of the property. [$\mu_{MIDDLETOWN}=0.710$, $\sigma_{MIDDLETOWN}=1.536$] [$\mu_{NILES}=0.166$, $\sigma_{NILES}=0.484$]	Computed from Wessex geocoded rail line data.	

Variable Name	Definition [mean, standard deviation] $N_{MIDDLETOWN}=7474$, $N_{NILES}=5416$	Source	Predicted Sign
XCR100,XCR200… XCR2900	1 =Conrail crossing within 100 feet of property, 0=otherwise. 1 =Conrail crossing within 100-200 feet of property, 0=otherwise. … 1=Conrail crossing within 2800-2900 feet of property, 0=otherwise. ***Mean values only*** ***Middletown mean values.*** $\mu_{100}=0.001, \mu_{200}=0.002, \mu_{300}=0.004, \mu_{400}=0.004$, $\mu_{500}=0.007, \mu_{600}=0.009, \mu_{700}=0.011, \mu_{800}=0.013$, $\mu_{900}=0.023, \mu_{1000}=0.013, \mu_{1100}=0.017$, $\mu_{1200}=0.013$, $\mu_{1300}=0.015, \mu_{1400}=0.025$, $\mu_{1500}=0.022, \mu_{1600}=0.016, \mu_{1700}=0.018$, $\mu_{1800}=0.026, \mu_{1900}=0.012, \mu_{2000}=0.018$, $\mu_{2100}=0.018, \mu_{2200}=0.016, \mu_{2300}=0.017$, $\mu_{2400}=0.011, \mu_{2500}=0.013, \mu_{2600}=0.010$, $\mu_{2700}=0.011, \mu_{2800}=0.010, \mu_{2900}=0.013$ ***Niles mean values:*** $\mu_{100}=0.0004, \mu_{200}=0.0002, \mu_{300}=0.0006$, $\mu_{400}=0.001, \mu_{500}=0.005, \mu_{600}=0.005, \mu_{700}=0.005$, $\mu_{800}=0.004, \mu_{900}=0.008, \mu_{1000}=0.004$, $\mu_{1100}=0.009, \mu_{1200}=0.007, \mu_{1300}=0.005$, $\mu_{1400}=0.010, \mu_{1500}=0.005, \mu_{1600}=0.006$, $\mu_{1700}=0.005, \mu_{1800}=0.007, \mu_{1900}=0.009$, $\mu_{2000}=0.008, \mu_{2100}=0.008, \mu_{2200}=0.008$, $\mu_{2300}=0.016, \mu_{2400}=0.006, \mu_{2500}=0.009$, $\mu_{2600}=0.007, \mu_{2700}=0.011, \mu_{2800}=0.007$, $\mu_{2900}=0.014$	Computed from FRA crossing data.	-

Variable Name	Definition [mean, standard deviation] $N_{MIDDLETOW}$=7474, N_{NILES}=5416	Source	Predicted Sign
XOT100,XOT200… XOT2900	1 =Other rail crossing within 100 feet of property, 0=otherwise. 1=Other rail crossing within 100-200 feet of property, 0=otherwise. ..... 1=other rail crossing within 2800-2900 feet of property, 0=otherwise. ***Middletown mean values:*** μ_{100}=0.003,μ_{200}=0.001,μ_{300}=0.002,μ_{400}=0.004, μ_{500}=0.008,μ_{600}=0.006,μ_{700}=0.013,μ_{800}=0.012, μ_{900}=0.012,μ_{1000}=0.010,μ_{1100}=0.013, μ_{1200}=0.014,μ_{1300}=0.007,μ_{1400}=0.017, μ_{1500}=0.014,μ_{1600}=0.011,μ_{1700}=0.012, μ_{1800}=0.016,μ_{1900}=0.009,μ_{2000}=0.009, μ_{2100}=0.010,μ_{2200}=0.013,μ_{2300}=0.011, μ_{2400}=0.012,μ_{2500}=0.011, μ_{2600}=0.010,μ_{2700}=0.014, μ_{2800}=0.011, μ_{2900}=0.010 ***Niles mean values:*** μ_{100}=0.001,μ_{200}=0.001,μ_{300}=0.001,μ_{400}=0.002, μ_{500}=0.001,μ_{600}=0.003,μ_{700}=0.002,μ_{800}=0.005, μ_{900}=0.004,μ_{1000}=0.003,μ_{1100}=0.010, μ_{1200}=0.004,μ_{1300}=0.004,μ_{1400}=0.007, μ_{1500}=0.004,μ_{1600}=0.006,μ_{1700}=0.004, μ_{1800}=0.007,μ_{1900}=0.009,μ_{2000}=0.005, μ_{2100}=0.006,μ_{2200}=0.010,μ_{2300}=0.007, μ_{2400}=0.006,μ_{2500}=0.009,μ_{2600}=0.007, μ_{2700}=0.008,μ_{2800}=0.007, μ_{2900}=0.007	Computed from FRA crossing data.	-

Table 2: Hedonic Regression Examining Effect of Conrail Action on Gradient

Dependent Variable: Log of Real Housing Price

Butler County - Middletown OH			Trumbull County - Niles, OH		
Variable	Coefficient	t-stat,	Variable	Coefficient	t-stat.
INTERCEPT	2.599586	0.954	INTERCEPT	19.18854	5.041
		Structural Variables			
AGEHOUSE	-0.003605	-4.730	AGEHOUSE	0.001663	1.379
AGEHOUSESQ	-1.69E-06	-0.263	AGEHOUSESQ	-6.06E-05	-4.759
BATHROOMS	0.038757	3.574	BATHROOMS	0.080780	5.291
BEDROOMS	0.031235	3.500	BEDROOMS	0.062951	5.757
OTHRROOMS	0.018200	3.454	OTHRROOMS	0.039541	4.383
FIREPLACE	0.138834	15.070	FIREPLACE	0.132238	9.690
GARAGESQFT	0.000160	7.333	GARAGESQFT	0.000511	8.773
GARAGESQFTSQ	-4.54E-08	-3.529	GARAGESQFTSQ	-2.07E-07	-2.838
LOTSIZE	4.66E-07	3.377	LOTSIZE	3.06E-08	0.829
NUMSTORY	-0.014627	-1.450	NUMSTORY	-0.040926	-2.754
BLDGAREA	0.000366	12.261	BLDGAREA	0.000376	7.099
BLDGAREASQ	-2.82E-08	-4.767	BLDGAREASQ	-4.13E-08	-3.152
POOL	0.090806	5.137	POOL	0.087729	5.326
		Neighborhood Variables			
OZONE	1740.092	1.724	OZONE	72000.92	3.830
AIRPT3MI	0.154556	3.166	AIRPT3MI	-0.371320	-2.045
AIRPTGRADIENT	-1.00E-05	-3.386	AIRPTGRADIENT	2.12E-05	2.164
HWYQUARTERMI	0.034014	0.184	HWYQUARTERMI	-0.083095	-0.962
HWYGRADIENT	7.66E-05	0.324	HWYGRADIENT	1.87E-06	0.020
LAKERIVER	-0.015279	-1.504	LAKERIVER	0.023809	1.293
MEDHHINC	3.23E-06	2.269	MEDHHINC	2.63E-05	4.049
MEDYRBLT	0.004236	3.056	MEDYRBLT	-0.004865	-2.217
%ASIAN	0.019647	1.253	%ASIAN	-0.131510	-3.620
%BLACK	-0.005272	-8.567	%BLACK	-0.002409	-0.660
%HISPANIC	0.040846	2.669	%HISPANIC	-0.066568	-1.612
%OCCUNIT	-0.008628	-2.888	%OCCUNIT	0.003670	0.335
%OWNEROCC	0.001622	2.068	%OWNEROCC	-0.009545	-3.597
%POVERTY	-0.007765	-5.833	%POVERTY	-0.003133	-0.450
POPDENSITY	1.73E-05	0.987	POPDENSITY	-0.000194	-3.184
POWERPLANT	0.538688	4.206	POWERPLANT	0.048822	1.497
SCHOOLD1	-0.079035	-1.256	SCHOOLD10	0.004330	0.104
SCHOOLD3	-0.067724	-0.865	SCHOOLD11	-0.076710	-3.052
SCHOOLD4	0.181150	1.807	SCHOOLD12	-0.049134	-0.675
SCHOOLD5	-0.033180	-1.213	SCHOOLD13	-0.346888	-2.631
SCHOOLD6	0.011935	0.277	SCHOOLD15	-0.291302	-5.321
SCHOOLD7	-0.048646	-0.319	SCHOOLD16	0.295825	2.201
SCHOOLD8	-0.044204	-0.631	SCHOOLD17	-0.041521	-0.706
---------------			SCHOOLD18	0.095545	0.622
---------------			SCHOOLD19	0.251790	3.104
---------------			SCHOOLD20	0.112457	1.522

---------------			SCHOOLD21	0.019476	0.244
---------------			SCHOOLD9	0.119579	0.905

Table 2: Hedonic Regression Examining Effect of Conrail Action on Gradient (continued)

Dependent Variable: Log of Real Housing Price

Butler County - Middletown OH			Trumbull County - Niles, OH		
Variable	Coefficient	t-stat.	Variable	Coefficient	t-stat.
		Neighborhood Variables (continued)			
TAXRATE	0.034956	1.114	TAXRATE	-0.032855	-3.124
TOXRELINV	0.000820	0.064	TOXRELINV	-0.034357	-1.504
COMMUTETIME	-0.005816	-1.703	COMMUTETIME	-0.004652	-0.618
SUPERFUND	-0.048741	-1.004	--------------		
MONROE	-0.044705	-2.137	GIRARD	-0.183618	-1.401
TRENTON	0.135241	1.885	NILES	-0.050085	-0.881
----------------			MINERALRIDGE	0.037482	0.437
----------------			MCDONALD	-0.187559	-1.306
		Time and Seasonal Dummy Variables			
SPRING	0.010458	0.960	SPRING	-0.034851	-2.240
SUMMER	0.010730	0.989	SUMMER	0.012985	0.873
FALL	0.026091	2.298	FALL	-0.005390	-0.345
YR89	0.058308	2.520	YR89	-0.011690	-0.416
YR90	0.073792	3.275	YR90	0.010870	0.420
YR91	0.054400	2.457	YR91	0.071216	2.730
YR92	0.095885	4.409	YR92	0.092451	3.529
YR93	0.133879	6.608	YR93	0.111867	4.520
YR94	0.173328	8.107	YR94	0.190190	8.215
YR95	0.212745	10.623	YR95	0.262164	11.133
YR96	0.262926	13.252	YR96	0.281355	10.190
YR97	0.278298	12.956	YR97	0.350577	6.816
		Railroad Related Variables			
XCRWITHIN2820	0.062328	2.315	XCRWITHIN2820	0.178816	2.636
$XGRADIENT_{CONRAIL}$	-2.71E-06	-0.197	$XGRADIENT_{CONRAIL}$	4.55E-05	1.498
$XGR_{CONRAIL}$ *IGNORE	1.61E-05	1.689	$XGR_{CONRAIL}$ *IGNORE	-9.89E-06	-0.743
$XWITHIN2820_{OTHER}$	-0.077921	-3.284	$XWITHIN2820_{OTHER}$	-0.084546	-1.217
$XGRADIENT_{OTHER}$	2.52E-05	2.287	$XGRADIENT_{OTHER}$	1.88E-05	0.632
NUMRRLINES	-0.020677	-5.610	NUMRRLINES	-0.026933	-1.953

$R^2_{ADJUSTED}$:	0.6693	$R^2_{ADJUSTED}$:	0.5623
Number observations:	7474	Number observations:	5416
Log likelihood:	-1921.165	Log likelihood:	-2294.923
F-statistic:	250.039	F-statistic:	106.423

Table 3: Hedonic Regression Contrasting SR and LR Effects of Policy Change
Dependent Variable: Log of Real Housing Price

Butler County - Middletown OH			Trumbull County - Niles, OH		
Variable	Coefficient	t-stat.	Variable	Coefficient	t-stat.
Intercept	2.592257	0.952	Intercept	19.15268	5.037
		Structural Variables			
AGEHOUSE	-0.003588	-4.704	AGEHOUSE	0.001572	1.309
AGEHOUSESQ	-1.84E-06	-0.286	AGEHOUSESQ	-6.00E-05	-4.745
BATHROOMS	0.038632	3.564	BATHROOMS	0.081622	5.352
BEDROOMS	0.031080	3.482	BEDROOMS	0.062515	5.723
OTHRROOMS	0.018215	3.456	OTHRROOMS	0.038967	4.322
FIREPLACE	0.138854	15.072	FIREPLACE	0.132791	9.739
GARAGESQFT	0.000160	7.379	GARAGESQFT	0.000519	8.875
GARAGESQFTSQ	-4.56E-08	-3.568	GARAGESQFTSQ	-2.13E-07	-2.919
LOTSIZE	4.65E-07	3.374	LOTSIZE	2.99E-08	0.811
NUMSTORY	-0.014777	-1.466	NUMSTORY	-0.038670	-2.597
BLDGAREA	0.000366	12.256	BLDGAREA	0.000373	7.021
BLDGAREASQ	-2.82E-08	-4.765	BLDGAREASQ	-4.08E-08	-3.103
POOL	0.090626	5.127	POOL	0.088283	5.361
		Neighborhood Variables			
OZONE	1735.944	1.717	OZONE	72820.85	3.881
AIRPT3MI	0.154782	3.169	AIRPT3MI	-0.376891	-2.078
AIRPTGRADIENT	-1.00E-05	-3.387	AIRPTGRADIENT	2.15E-05	2.194
HWYQUARTERMI	0.042944	0.233	HWYQUARTERMI	-0.079291	-0.919
HWYGRADIENT	6.07E-05	0.258	HWYGRADIENT	-3.58E-07	-0.004
LAKERIVER	-0.015218	-1.498	LAKERIVER	0.023324	1.268
MEDHHINC	3.26E-06	2.288	MEDHHINC	2.61E-05	4.020
MEDYRBLT	0.004242	3.061	MEDYRBLT	-0.004828	-2.203
%ASIAN	0.019618	1.253	%ASIAN	-0.130283	-3.590
%BLACK	-0.005273	-8.576	%BLACK	-0.002558	-0.701
%HISPANIC	0.040840	2.669	%HISPANIC	-0.067592	-1.639
%OCCUNIT	-0.008638	-2.891	%OCCUNIT	0.003314	0.303
%OWNEROCC	0.001611	2.054	%OWNEROCC	-0.009564	-3.606

%POVERTY	-0.007745	-5.815	%POVERTY	-0.003011	-0.432
POPDENSITY	1.74E-05	0.992	POPDENSITY	-0.000193	-3.187
POWERPLANT	0.531633	4.155	POWERPLANT	0.049909	1.533
SCHOOLD1	-0.074180	-1.176	SCHOOLD9	0.118767	0.901
SCHOOLD3	-0.068095	-0.871	SCHOOLD10	0.004307	0.104
SCHOOLD4	0.174579	1.745	SCHOOLD11	-0.074916	-2.984
SCHOOLD5	-0.032969	-1.206	SCHOOLD12	-0.045783	-0.629
SCHOOLD6	0.011271	0.262	SCHOOLD13	-0.349975	-2.657
SCHOOLD7	-0.050234	-0.330	SCHOOLD15	-0.289220	-5.290

Table 3: Hedonic Regression Contrasting SR and LR Effects of Policy Change (continued)
Dependent Variable: Log of Real Housing Price

Butler County - Middletown OH			Trumbull County - Niles, OH		
Variable	Coefficient	t-stat.	Variable	Coefficient	t-stat.
		Neighborhood Variables (continued)			
SCHOOLD8	-0.045339	-0.649	SCHOOLD16	0.295759	2.206
---------------			SCHOOLD17	-0.043118	-0.733
---------------			SCHOOLD18	0.100725	0.655
----------------			SCHOOLD19	0.252809	3.120
----------------			SCHOOLD20	0.114176	1.546
----------------			SCHOOLD21	0.018956	0.238
TAXRATE	0.034104	1.089	TAXRATE	-0.033313	-3.176
SUPERFUND	-0.048049	-0.988	-------------		
TOXRELINV	0.000873	0.068	TOXRELINV	-0.034104	-1.495
COMMUTETIME	-0.005840	-1.710	COMMUTETIME	-0.004331	-0.576
MONROE	-0.044367	-2.121	GIRARD	-0.184188	-1.408
TRENTON	0.135074	1.885	NILES	-0.051894	-0.913
----------------			MINERALRIDGE	0.037895	0.442
----------------			MCDONALD	-0.191914	-1.335
		Time and Seasonal Variables			
SPRING	0.010297	0.946	SPRING	-0.035492	-2.280
SUMMER	0.010303	0.949	SUMMER	0.012868	0.865
FALL	0.025027	2.195	FALL	-0.004489	-0.287
YR89	0.058327	2.521	YR89	-0.011994	-0.427
YR90	0.073726	3.272	YR90	0.010585	0.409
YR91	0.054779	2.473	YR91	0.069629	2.668
YR92	0.101588	4.616	YR92	0.082928	3.133
YR93	0.137292	6.733	YR93	0.107132	4.309
YR94	0.174158	8.140	YR94	0.190657	8.236
YR95	0.210805	10.532	YR95	0.268683	11.367
YR96	0.258437	12.993	YR96	.293847	10.523

YR97	0.272157	12.511	YR97	0.373181	7.227
		Railroad Related Variables			
$XWITHIN2820_{CONRAIL}$	-0.062234	-2.312	$XWITHIN2820_{CONRAIL}$	-0.174451	-2.568
$XGRADIENT_{CONRAIL}$	-2.84E-06	-0.206	$XGRADIENT_{CONRAIL}$	4.36E-05	1.434
$XGR_{CONRAIL}$*IGNORE	3.80E-06	0.294	$XGR_{CONRAIL}$*IGNORE	3.40E-05	1.678
$XGR_{CONRAIL}$*DAYS	1.16E-08	1.487	$XGR_{CONRAIL}$*DAYS	-4.74E-08	-2.938
$XWITHIN2820_{OTHER}$	-0.078035	-3.287	$XWITHIN2820_{OTHER}$	-0.084231	-1.208
$XGRADIENT_{OTHER}$	2.53E-05	2.292	$XGRADIENT_{OTHER}$	1.87E-05	0.628
NUMRRLINES	-0.020692	-5.618	NUMRRLINES	-0.028410	-2.069
Number observations:	7474		Number observations:	5416	
$R^2_{ADJUSTED}$:	0.666649		$R^2_{ADJUSTED}$:	0.562849	
Log likelihood:	-1920.250		Log likelihood	-2291.329	
F-statistic:	245.997		F-statistic	105.060	

Table 4: Hedonic Regression in High Density Areas
Dependent Variable: Log of Real Housing Price

Table 4a: Hedonic Regression Examining Effect of Conrail Action on Gradient

Butler County - Middletown OH			Trumbull County - Niles, OH		
		Railroad Related Variables			
Variable	Coefficient	t-stat.	Variable	Coefficient	t-stat.
XCRWITHIN2820	-0.157467	-3.852	XCRWITHIN2820	-0.204961	-2.543
$XGRADIENT_{CONRAIL}$	-1.71E-05	-0.982	$XGRADIENT_{CONRAIL}$	4.92E-05	1.444
$XGR_{CONRAIL}$*IGNORE	1.25E-05	1.056	$XGR_{CONRAIL}$*IGNORE	-8.53E-06	-0.605
$XWITHIN2820_{OTHER}$	-0.172888	-5.863	$XWITHIN2820_{OTHER}$	-0.033623	-0.427
$XGRADIENT_{OTHER}$	3.67E-05	2.653	$XGRADIENT_{OTHER}$	1.12E-06	0.034
NUMRRLINES	-0.009787	-1.999	NUMRRLINES	-0.038833	-2.602

Table 4b: Hedonic Regression Contrasting SR and LR Effects of Policy Change

Butler County - Middletown OH			Trumbull County - Niles, OH		
		Railroad Related Variables			
Variable	Coefficient	t-stat.	Variable	Coefficient	t-stat.
XCRWITHIN2820	-0.156193	-3.843	XCRWITHIN2820	-0.199191	-2.462
$XGRADIENT_{CONRAIL}$	-1.68E-05	-0.968	$XGRADIENT_{CONRAIL}$	4.76E-05	1.394

$XGR_{CONRAIL}$*IGNORE	3.26E-06	0.194
$XGR_{CONRAIL}$*DAYS	8.71E-09	0.805
$XWITHIN2820_{OTHER}$	-0.173003	-5.869
$XGRADIENT_{OTHER}$	3.68E-05	2.659
NUMRRLINES	-0.009827	-2.007

$XGR_{CONRAIL}$*IGNORE	4.70E-05	2.231
$XGR_{CONRAIL}$*DAYS	-4.09E-08	-2.486
$XWITHIN2820_{OTHER}$	-0.034788	-0.439
$XGRADIENT_{OTHER}$	1.09E-06	0.033
NUMRRLINES	-0.039742	-2.671

Appendix A: Hedonic Regression Testing Proximity Effects Using 100 ft. Dummy Variables

Dependent Variable: Log of Real Housing Price

Butler County -Middletown OH			Trumbull County - Niles OH		
Variable	Coefficient	t-stat.	Variable	Coefficient	t-stat.
Intercept	2.298760	0.846	Intercept	20.00312	5.123
		Structural Variables			
AGEHOUSE	-0.003545	-4.641	AGEHOUSE	0.001574	1.291
AGEHOUSESQ	-1.49E-06	-0.230	AGEHOUSESQ	-5.97E-05	-4.620
BATHROOMS	0.042348	3.884	BATHROOMS	0.080706	5.258
BEDROOMS	0.030953	3.461	BEDROOMS	0.062654	5.672
FIREPLACE	0.136334	14.615	FIREPLACE	0.132061	9.625
OTHRROOM	0.018001	3.400	OTHRROOM	0.038898	4.294
GARAGESQFT	0.000155	7.208	GARAGESQFT	0.000509	8.678
GARAGESQFTSQ	-4.32E-08	-3.831	GARAGESQFTSQ	-2.04E-07	-2.771
LOTSIZE	4.57E-07	3.304	LOTSIZE	3.32E-08	0.889
NUMSTORY	-0.013935	-1.376	NUMSTORY	-0.040155	-2.684
BLDGAREA	0.000362	12.008	BLDGAREA	0.000374	7.032
BLDGAREASQ	-2.79E-08	-4.634	BLDGAREASQ	-4.12E-08	-3.126
POOL	0.090107	5.106	POOL	0.087521	5.335
		Neighborhood Variables			
OZONE	1025.118	0.973	OZONE	68448.03	3.593
AIRPT3MI	0.160539	3.218	AIRPT3MI	-0.343522	-1.871
AIRPTGRADIENT	-1.07E-05	-3.527	AIRPTGRADIENT	1.98E-05	1.998
HWYQUARTERMI	0.004460	0.024	HWYQUARTERMI	-0.114716	- 1.274
HWYGRADIENT	0.000119	0.505	HWYGRADIENT	1.84E-05	0.192
LAKERIVR	-0.015433	-1.503	LAKERIVR	0.028248	1.502
MEDHHINC	2.51E-06	1.753	MEDHHINC	2.81E-05	4.236
MEDYRBLT	0.004381	3.171	MEDYRBLT	-0.005244	-2.334
%ASIAN	0.018059	1.110	%ASIAN	-0.129049	-3.444
%BLACK	-0.005419	-8.784	%BLACK	-0.003906	-1.019
%HISPANIC	0.026670	1.716	%HISPANIC	-0.067698	-1.546
%OCCUNIT	-0.007467	-2.496	%OCCUNIT	0.002 143	0.189
%OWNEROCC	0.001764	2.263	%OWNEROCC	-0.009476	-3.487
%POVERTY	-0.007470	-5.563	%POVERTY	-0.000307	-0.043
POPDENSITY	1.45E-05	0.823	POPDENSITY	-0.000 175	-2.805
POWERPLANT	0.593610	4.510	POWERPLANT	0.057694	1.644
SCHOOLD1	-0.120311	-1.752	SCHOOLD9	0.127185	0.953
SCHOOLD3	-0.077896	-0.993	SCHOOLD1 0	0.011760	0.279
SCHOOLD4	0.248447	2.281	SCHOOLD11	-0.074208	-2.927
SCHOOLD5	-0.030416	-1.106	SCHOOLD12	-0.039973	-0.541
SCHOOLD6	0.007641	0.177	SCHOOLD13	-0.319661	-2.396
SCHOOLD7	-0.081398	-0.541	SCHOOLD15	-0.28 13 83	-5.080
SCHOOLD8	-0.058046	-0.826	SCHOOLD 16	0.302397	2.230
---------------			SCHOOLD 17	-0.022949	-0.384
---------------			SCHOOLD 18	0.082267	0.529
---------------			SCHOOLD 19	0.260646	3.165

---------------			SCHOOLD20	0.133609	1.781
---------------			SCHOOLD21	0.025819	0.321

Appendix A: Hedonic Regression Testing Proximity Effects Using 100 ft. Dummy Variables

Dependent Variable: Log of Real Housing Price

Butler County -Middletown OH			Trumbull County - Niles OH		
Variable	Coefficient	t-stat.	Variable	Coefficient	t-stat.
		Neighborhood Variables - continued			
TAXRATE	0.031116	0.992	TAXRATE	-0.03359 1	-3.186
SUPERFUND	-0.048913	-1.000	--------------		
TOXRELINV	-0.003032	-0.235	TOXRELINV	-0.036545	-1.552
COMMUTETIME	-0.008037	-2.338	COMMUTETIME	-0.004507	-0.583
MONROE	-0.049884	-2.355	GIRARD	-0.188096	-1.422
TRENTON	0.127851	1.775	NILES	-0.061043	-1.050
--------------			MINERALRIDGE	0.03208 1	0.370
--------------			MCDONALD	-0.177773	- 1.223
		Time and Seasonal Dummy Variables			
SPRING	0.010186	0.932	SPRING	-0.035863	-2.310
SUMMER	0.009838	0.904	SUMMER	0.013833	0.931
FALL	0.026090	2.300	FALL	-0.005259	-0.335
YR89	0.059907	2.588	YR89	-0.009604	-0.341
YR90	0.074048	3.271	YR90	0.013200	0.507
YR91	0.058945	2.655	YR91	0.071771	2.726
YR92	0.098187	4.481	YR92	0.097094	3.683
YR93	0.135319	6.623	YR93	0.116162	4.655
YR94	0.175926	8.157	YR94	0.194194	8.329
YR95	0.215776	10.707	YR95	0.265398	11.181
YR96	0.265003	13.226	YR96	0.282968	10.224
YR97	0.278237	12.832	YR97	0.349307	6.662
		Railroad Related Variables			
NUMRRLINES	-0.021208	-5.577	NUMRRLINES	-0.036638	-2.476
XCR100	-0.187579	-1.048	XCR100	-0.740113	-4.484
XCR200	0.051491	0.376	XCR200	-0.415897	-2.172
XCR300	-0.083846	-1.297	XCR300	-0.759481	-2.446
XCR400	-0.057203	-0.778	XCR400	-0.001607	-0.008
XCR500	-0.169277	-3.148	XCR500	-0.036436	-0.348
XCR600	-0.083878	-1.773	XCR600	-0.147672	-1.029
XCR700	-0.020055	-0.539	XCR700	-0.159792	-1.671
XCR800	-0.047995	-1.101	XCR800	0.068993	0.635
XCR900	-0.083452	-2.550	XCR900	-0.116083	-1.330
XCR1000	-0.044098	-1.176	XCR1000	-0.022734	-0.161
XCR1100	-0.074186	-1.955	XCR1100	-0.124057	-1.587
XCR1200	-0.127626	-3.035	XCR1200	-0.135349	-1.642
XCR1300	-0.046368	-1.382	XCR1300	0.102925	1.217
XCR1400	-0.114592	-3.627	XCR1400	-0.107087	-1.506
XCR1500	-0.115550	-3.623	XCR1500	-0.151294	-1.

XCR1600	-0.068234	-2.326	XCR1600	-0.095441	-1.539
XCR1700	-0.051031	-1.765	XCR1700	-0.114810	-1.368
XCR1800	-0.080993	-2.801	XCR1800	-0.079020	-1.421
XCR1900	-0.119948	-2.890	XCR1900	-0.102925	-1.603
XCR2000	-0.060347	-1.509	XCR2000	-0.108539	-1.563

Appendix A: Hedonic Regression Testing Proximity Effects Using 100 ft. Dummy Variables
Dependent Variable: Log of Real Housing Price

Butler County -Middletown OH			Trumbull County - Niles OH		
Variable	Coefficient	t-stat.	Variable	Coefficient	t-stat.
		Railroad Related Variables - continued			
XCR2100	-0.099157	-2.914	XCR2100	-0.053318	-0.989
XCR2200	0.014175	0.426	XCR2200	-0.166737	-2.665
XCR2300	-0.051198	-1.577	XCR2300	-0.068069	-1.577
XCR2400	-0.116499	-2.971	XCR2400	-0.129753	-1.755
XCR2500	-0.101598	-2.784	XCR2500	-0.054538	-1.192
XCR2600	-0.050706	-1.143	XCR2600	-0.070952	-1.401
XCR2700	0.013235	0.277	XCR2700	-0.085906	-1.478
XCR2800	-0.080805	-2.049	XCR2800	0.022768	0.455
XCR2900	-0.002111	-0.074	XCR2900	-0.131729	-2.621
XCR_{2820}*IGNORE	0.025579	1.575	XCR_{2820}*IGNORE	-0.039501	-1.494
XOT100	0.031852	0.350	XOT100	0.168028	1.109
XOT200	-0.115023	-0.766	XOT200	0.030992	0.163
XOT300	-0.043709	-0.555	XOT300	0.096720	0.965
XOT400	-0.073441	-1.150	XOT400	-0.274078	-1.621
XOT500	-0.105243	-2.224	XOT500	-0.422010	-1.190
XOT600	0.005533	0.142	XOT600	-0.202841	-1.209
XOT700	-0.059213	-1.214	XOT700	-0.111848	-0.781
XOT800	-0.106039	-3.004	XOT800	-0.156729	-1.246
XOT900	-0.045912	-1.481	XOT900	-0.076304	-0.761
XOT1000	0.008565	0.261	XOT1000	0.008442	0.070
XOT1100	-0.025872	-0.619	XOT1100	-0.042352	-0.602
XOT1200	-0.101251	-2.887	XOT1200	0.029362	0.291
XOT1300	-0.050748	-1.009	XOT1300	-0.094918	-1.003
XOT1400	0.002778	0.085	XOT1400	-0.051611	-0.591
XOT1500	-0.108582	-2.998	XOT1500	-0.093344	-0.952
XOT1600	0.009006	0.229	XOT1600	-0.091695	-1.183
XOT1700	-0.098249	-2.575	XOT1700	-0.038362	-0.543
XOT1800	-0.056311	-1.942	XOT1800	-0.082017	-1.511
XOT1900	0.011938	0.252	XOT1900	0.068796	1.405
XOT2000	-0.104009	-2.412	XOT2000	-0.024074	-0.292
XOT2100	-0.016431	-0.395	XOT2100	-0.037677	-0.450
XOT2200	0.065240	1.838	XOT2200	-0.069779	-1.451
XOT2300	-0.091731	-2.418	XOT2300	-0.049551	-1.144
XOT2400	0.052451	1.543	XOT2400	0.043366	0.830

XOT2500	0.001363	0.037	XOT2500	-0.040240	-0.942
XOT2600	-0.062179	-1.489	XOT2600	-0.038370	-0.711
XOT2700	-0.047929	-1.338	XOT2700	-0.031504	-0.411
XOT2800	0.016251	0.408	XOT2800	-0.021040	-0.376
XOT2900	0.051580	1.233	XOT2900	0.038567	0.753
R^2_{ADJ}:	0.668		$R^2_{ADJ.}$:	0.572	
Log likelihood:	-1874.489		Log likelihood:	-2266.882	
F-statistic:	133.094		F-statistic:	59.004	
Number Obs.	7474		Number Obs.:	5416	