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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 21000 single-family residential home sales in three communities (Middletown, OH; Niles, OH; and Framingham, MA) over the period 1987-1997 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 on property values can also be determined. The findings indicate that, other things equal, being within 1000 feet of a rail line depresses the sale price of a property from 5% to 13% on average. An evaluation of the independent influence of railroad crossings (again holding the impact of other factors constant) reveals that being within the audible range (approximately 2300 feet) of a rail crossing can also reduce property values. Specifically, detrimental impacts from Conrail crossings averaged about 7% in the period prior to the Conrail action on whistle bans. The degradation in property values from the rail crossings of other rail companies were in the 8%-13% range. Finally, an investigation of the action by Conrail to ignore whistle bans reveals temporary, but not permanent perceptible impacts from the whistle ban. Specifically, property values fell by almost 7% in one area (Butler county, OH) following the ban, but they gradually increased over time. Within 3 years, the detrimental impact of the Conrail action was eliminated. 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.

Ignoring Whistle Bans and Residential Property Values:
An Hedonic Housing Price Analysis[1]

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

[1] The author would like to thank Leslie Nieves for helpful comments on earlier drafts, as well as Theresa Kvitek for assistance in data collection and Kyra Taylor and Mary Snider for assistance with GIS applications.

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 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 Hen-in, 1997, Metz and Clark, 1997; and Clark, Michelbrink, Allison and Metz, 1997, Clark and Allison, 1999) 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, these studies 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 four 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 and one city in Massachusetts.

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 Study Areas

We estimate an hedonic model using a sample of properties which sold in three counties; two are in Ohio, and one is in Massachusetts. The Ohio counties include Butler County in the southwestern part of the state, which contains Middletown and Trumbull County in the

[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.

northeastern OH, which contains Niles. The Massachusetts data includes transactions from Middlesex County, which contains Framingham. The data sets were obtained from two different sources: The Ohio data 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. The Massachusetts data was obtained from Experían and it covers the period Jan. 1986 to July 1997. Of the 11,518 observations in Middlesex county, 67.7% sold after the Conrail action. All property data are geocoded to the street address of house which permits matching of the property to the salient locational attributes in the vicinity of the property. The demographic characteristics of each county are described in Table 1.

Table 1: Demographic Characteristics of Study Areas*

Demographic Characteristic	Butler County Ohio	Trumbull County Ohio	Middlesex County Massachusetts
Median Family Income	$38,673	$33,313	$52,112
Median Housing Value	$72,500	$53,200	$192,200
Median Gross Rent	$415	$346	$671
Percent Owner Occupied	69.22%	73.09%	59.63%
Population (persons)	291,479	227,813	1,398,468
Population Density (persons/square mile)	154.12	91.41	419.69
Percent Black	4.50%	6.68%	2.87%
Percent Asian	0.91%	0.42%	3.70%
Percent White	94.31%	92.58%	92.05%
Percent Hispanic	0.50%	0.64%	3.39%

*County data, 1990 U.S. Census of Population and Housing

Of the three geographic regions, Middlesex county which is a western suburb of Boston is the most densely populated of the three counties. It also has the highest median family income as well as the highest home values and rents. Butler county is more affluent than Trumbull. All three regions are predominantly white, although there are some differences in minority compositions between the three areas. Minority populations in the Ohio counties are predominantly black, whereas Middlesex has higher concentrations of Asian and Hispanic residents.

b. Description of Model

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[3], and the model is specified by equation (1).

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

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. The variables in this category differ slightly between the Ohio and Massachusetts specifications. These include the number of bedrooms, bathrooms (bathrooms for OH; half baths and full baths for MA) and other rooms; the number of fireplaces, the age of the structure, the size of the lot on which the structure is located, and the square footage of the structure itself and the garage (Ohio properties only). Finally, the presence of a pool (Ohio properties only) and the number of stories of the property area also controlled. The age of the house and the two areal measures are included in both linear and quadratic forms so as to account for potential nonmonotonicities of these variables on sale prices of housing.[4] One would expect that structural features which increase the housing services generated by a property would increase sale price.

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[3] 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.

[4] 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 area measures 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.

ii. Neighborhood and Time Trend Variables

Since the both Dataquick and Experían data are geocoded to the property address, this permits the matching of a wide range of neighborhood characteristics to each property. The ArcView PC-based GIS package is used to map each variable to the associated property. Each Each property is matched to a census block group, and the characteristics of that block group are then assigned to the property. Among the characteristics included are the percent of the houses that are occupied (% Occupied), the percent of the occupied units that are owner occupied (%Owner occupied), and the racial and ethnic mix of the block group (%Asian, %Black and %Hispanic). Also included in this set of demographic controls is the median household income of the block group (Median HH Income). Finally, the age of housing in the neighborhood (Median year built) is included to proxy the age of the neighborhood, and the average commute time within the block group (Commute time) is included to account for enhancements to housing prices that result from reduced travel times. Also included is population density 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-family homes. 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 ArcView GIS to determine how close each property is to various types of noxious activity. Specifically, we examine noxious activity related to proximity to interstate highways and airports.. 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 ¼ mile for highways. Noise levels outside these ranges are assumed to be too low to influence property markets Air quality in the neighborhood is proxied by distance from the nearest air quality monitor. Since monitors are not uniformly dispersed throughout metropolitan areas, but rather are placed in areas which are more likely to have readings, we expect properties located at greater distances from the from a monitor to experience higher air quality. Proximity to hazardous materials is proxied by the presence of Superfund sites within a 3 mile radius of each property' and the presence of manufacturing facilities on the Toxic Release Inventory within a 1 mile radius. Finally, we include proximity (i.e., within 1 mile) to power plants to proxy emissions associated with these facilities.

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[5] Note that only Bulter and Middlesex counties have sites on the National Priorities (aka Superfund) list.

Next, proximity to streams, lakes and rivers is included to proxy access to aesthetic and recreational amenities. We include the property tax rate for the residence to measure the local property tax burden and dummy variables for the school district 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 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 1987 for the Ohio data and 1986 for Massachusetts. 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 omitted 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. Rails crossing that are maintained by Conrail are distinguished from other crossing data. Note that a crossing is classified as a Conrail crossing if it is maintained by Conrail, or if any Conrail trains travel through the crossing. 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 train, so we adopt an operational definition of an impact zone to be properties within 2326 feet of a rail crossing. We split the impact zone into moderate and high impact ranges by defining the area within 1000 feet as severe impact and the area 1000 to 2326 as a moderate impac zone.

In general, homes in Butler County are closer to rail crossings than the other study area. Specifically, 22.5% of the properties in our sample fall within 2326 feet of Conrail crossings in Butler county whereas 10% and 9.9% are within that distance of Conrail crossings for Trumbull and Middlesex counties respectively. Likewise, the properties in Butler are also closer to crossings of other rail companies on average (i.e., 12.2% are within the 2326 feet for Butler county; 3.8% are within that impact zone for Trumbull county and 2.8% are within that distance for Middlesex county). Noise and vibration may also result from proximity to rail lines, even if the property is not close to a rail crossing. Thus, it is important to control for proximity to both rail lines and rail crossings. We construct a 1000 foot buffer zone (Line Impact Area) around each rail line, and again, the line classified by rail company. It is assumed that noise and vibration which is unrelated to whistle noise will dissipate within 1000 feet. As with the crossing data, Butler properties tend to be closer than those in other counties to rail lines with 14.7% within 1000 feet of Conrail lines, and 9.6% within that distance of other lines. This is in contrast to the findings for Trumbull county (5.4% for Conrail lines and 5.0% for other lines) and

Middlesex county (12.1% for Conrail lines and 1.6% for other lines).

Two different specifications are examined for each of the three geographic regions. The first specification uses dummy variables to distinguish between impacts in the moderate and severe impact areas. This is given by equation (2) below.

$$\ln(\text{Rprice}) = \beta_0 + \beta_1 \text{*Control} + \beta_2\text{*LIA}_j + \beta_3\text{*XIA}_k + \beta_4\text{* XIA}_{k:\text{Conrail}} \text{*Ignore} + \beta_5\text{* XIA}_{k:\text{Conrail}} \text{*Ignore*DaysSince} \quad (2)$$

where ln(Rprice) =the log of the real sales price

Control= Vector of control variables, and β_1 a vector of coefficients on those variables;
LIA = Line impact area (i.e., within 1000 feet of the rail line) for j=Conrail, Other;
XIA = Crossing impact area for k=moderate, severe;
Ignore = A zero-one dummy variable which takes on a value of one if the property sold at least 45 days after the date which Conrail began ignoring the whistle ban[6].
Days Since is the number of days that have passed since 45 days after the Conrail action.

Thus, β_2 is expected to be negative if proximity to a train line represents a local disamenity. The coefficients on the crossing dummy variables (i.e., estimates of β_3) would also be expected to be negative, with the coefficient on the XIA_{severe} anticipated to be more negative than the coefficient on $XIA_{moderate}$. If the action by Conrail is detrimental to property values, then the estimate of β_4 should be negative and statistically significant. That is, ignoring the whistle ban would significantly reduce sale prices on property below the baseline level established by the estimates of β_3. Finally, the last term is designed to capture temporal differences in property value impacts, such as those identified by Kiel and McClain (1994). If negative impacts grow over time (e.g., the area is stigmatized, this coefficient could be negative, implying continued declines in property prices after the action. On the other hand, if negative impacts are only temporary, then one would expect a positive estimate of β_5.

The second specification estimates continuous distance gradients for the entire impact area rather than dividing the crossing impact area into moderate and severe ranges with separate dummy variables. It then investigates the influence of the Conrail action on the slope of the gradient. The model is given by equation (3).

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[6] Properties which closed within 45 days of the Conrail action would not have been influenced by the action for two reasons. First, Conrail did not provide any advanced warning of its decision to discontinue observing the whistle ban. Furthermore, it typically takes takes 4-6 weeks to close on a property. Hence, properties selling within 45 days of the Conrail action would have had an accepted offer prior to the action to ignore the bans. While it may be possible for the buyer to withdraw the offer once Conrail began blowing their whistles, those transactions would not take place within the 45 day period subsequent to the action.

$$\ln(Rprice) = \beta_0 + \beta_1{*}Control + \beta_2{*}LIA_j + \beta_3{*}LIA_j{*}Distance_j + \beta_4{*}XIA_j + \beta_5{*}XIA_j * Distance_j + \beta_6{*} XIA_{Conrail} {*}Distance_{Conrail} {*}Ignore + \beta_7{*} XIA_{Conrail} * Distance_{Conrail} {*}Ignore{*}Days\ Since$$

where ln(Rprice), Control, LIA, Ignore and Days Since are defined as before.

XIA_j = 2326 foot radius crossing impact area for j=Conrail, Other crossing.

$Distance_j$ = distance from property to rail crossing, or rail line j

The estimate of the coefficient on $LIA_j{*}Distance_j$ (i.e., β_3) represents the rate at which housing prices change with distance from the rail line. If proximity to rail lines is undesirable, then it would be expected that $\beta_2<0$ and $\beta_3>0$. The coefficient estimate on XIA_j (i.e., β_4) represents the baseline impact associated with residing within the impact area. In addition, as distance from the crossing increases, property prices should rise if being close to the crossing is undesirable. Hence, the estimate of β_5 is expected to be positive. If the Conrail decision to ignore the ban increases the premium for distance from the crossing, then the estimate of β_6 would be positive, and the expected sign on β_7 depends on whether property impacts decline, or are accentuated over time.

d. Empirical Findings

Separate regressions are estimated for each of the three geographic regions, and a White test revealed evidence of heteroskedasticity in all regressions. White's correction technique is used to generate consistent estimates of standard errors. All data descriptions and descriptive statistics are reported in Table 2, whereas the findings on the two specifications are reported in Tables 3 and 4 respectively. Since the coefficients and the t-scores on control variables differ very little between the specifications, they are only discussed for the first specification. In addition, the discussion will focus on coefficients that are statistically significant in a two-tailed test at the 90% level of confidence or higher. The regression models explained 67% of the variation in the log of real sale prices in Butler county; 61% of the variation in Trumbull county; and 49.1% in Middlesex county.

Structural Variables

The influence of age on housing price is generally negative, with the linear coefficient negative and significant in Butler and Middlesex counties. The quadratic term is positive in Middlesex, but the age at which housing prices begin to increase is well beyond the relevant range of data. For Trumbull county the linear age term is positive but insignificant, and the negative quadratic term is negative and significant. Treating the linear term as a point estimate, housing prices rise for the first 2.8 years and then fall thereafter. Holding square footage constant, additional bedrooms, bathrooms and other rooms significantly increase housing values in the Ohio samples. For Butler county, an additional bedroom increases the sale price by 3.2% and an additional full bathroom increases the sale price by about 2.7%. Other rooms increase the price by 1.6%. Additional full bathrooms have a much stronger influence in Trumbull, increasing property values by nearly 11%. Bedrooms and other rooms increase values 4.2% and 3.1% respectively. In contrast, neither bedrooms nor other rooms is statistically significant for Middlesex county. An additional full or half bathroom both increase the real sale price by about 8%. The presence of a fireplace significantly increases the home sale price by approximately 12%-13% in the Ohio samples, and 6.2% in Middlesex county. 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 6.6% in Trumbull, and about 1.9% in Butler county whereas the effect is opposite in the Massachusetts, increasing the real sale price by more than 5%. The presence of a swimming pool significantly raises the sale price of the property by about 7.3% in Trumbull and 8.5% in Butler county. Turning to the square footage measures, consistent with Palmquist (1984), the square footage of the property increases housing prices but at a decreasing rate. Other things equal, the real housing price falls after 6554 sq.ft. in Butler county, 4241 sq.ft. in Trumbull county, and 5567 sq.ft. in Middlesex county. Evaluating this at the mean building area value in each sample (i.e., 1389 sq.ft. in Butler, 1465 sq.ft. in Trumbull, and 1877 sq.ft. in Middlesex), an increment of 100 square feet increases housing value by 1.8% in Butler county, and 3.9% in Trumbull county, and 1.8% in Middlesex county. 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 1.5% in Butler county and 2.8% in Trumbull county (again, these are evaluated at the mean values for garage area). This higher impact of garage space in Trumbull is due to stronger marginal effects resulting from the magnitude of the coefficients in the Trumbull regression, combined with garage sizes that are on average about 34% larger in Trumbull. Finally, the size of the lot significantly increases the sale price of the housing unit by approximately 2.3% per acre in the Butler county area and 2.8% in Middlesex county. The coefficient is statistically insignificant in the Trumbull county regression. area. In both Ohio locations, average lot size is approximately ½ acre, and it is about ¾ acre in the Massachusetts county.

Neighborhood Characteristics

The influence of neighborhood characteristics varies across 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, one would expect that other things equal, the distance from an air quality monitor should increase real housing prices, since monitors are placed in areas of relatively lower air quality. This is the case for Middlesex county, where housing prices rise about 1.4% per mile. However, the opposite is true for Trumbull county, with real housing prices falling, the greater the distance from the monitor. Note, the coefficient is not quite significant at the 90% level of confidence. Nonetheless, it is possible that there are other positive features of the community (e.g., cultural centers, employment districts, etc.) that happen to be located near the monitors, that are overwhelming the influence of the air quality monitor.

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 Butler county 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 17% higher for properties within 3 miles of the airport, as compared to those outside that range. In addition, housing prices fall by approximately 5.2% per mile with distance from the airport. This so-called positive housing price gradient (i.e., positive price-distance relationship) 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 Trumbull county. Home sales prices are nearly 30% lower in the 3 mile buffer area in Trumbull, and they rise by about 10% per mile further away from the airport. Although it is possible that the coefficients in Trumbull are reflecting primarily the influence of noise, they are likely capturing other influences as well. This may include traffic congestion, industrial activity, and other activities associated with proximity to airports. Proximity to highways is also measured using a buffer area to proxy noise (i.e., ¼ mile) and a distance variable. It is assumed that highway noise is dissipated beyond ¼ miles. While the coefficient on the dummy variable for the buffer zone is negative, and the coefficient on the distance variable is positive in all three regressions, both coefficients are only significant in the Massachusetts county. They suggest that home prices are 7% lower within the buffer zone, and they rise by about 10% per ¼ mile.

Turning to the neighborhood measures drawn from 1990 census block group data, it is not surprising to find that real housing prices are higher in more affluent neighborhoods. Older neighborhoods, as determined by a smaller value for the Median Year Built variable, have significantly lower priced housing in Butler and Trumbull counties, although the latter is not statistically significant. In contrast, the coefficient is negative and significant at the 90% level of confidence in Middlesex county suggesting that older established neighborhoods are more desirable. Surprisingly, a high percent of occupied units significantly decreases the sale price of housing in Trumbull and Middlesex counties 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 in Ohio. However, we noted that newer neighborhoods appear to be less desirable in Massachusetts. Likewise, whereas an increase in the percent of occupied homes that are owner-occupied raises housing prices in Butler and Middlesex counties, it actually has the opposite effect in Trumbull. Population density, which can proxy both amenities and disamenities associated with a neighborhood, on net has a positve and significant influence on housing prices in the Trumbull regression model. The racial and ethnic mix of the neighborhood exerts a statistically important influence in all three housing markets. Specifically, increases in the Black population, decrease housing prices in the Ohio regions; increases in Asian populations decrease real prices in Trumbull and Middlesex; and an increase in the Hispanic population decreases home sale prices in Trumbull. It should be noted from Table 1 that concentrations of all minority groups are low in all three communties, with White populations at least 92% in each area. 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 in the Butler county regression equation. An increase in commuting time of IO minutes depresses housing prices about 12.7% in that city.

Proximity to a non-nuclear power generating plant exerts no significant influence on home prices in either of the Ohio counties, whereas the closest power plant is more than three miles from the closest property in Middlesex county. Proximity to a chemical manufacturing facility on the toxic release inventory decreases home prices in Butler, but it is not significant. In contrast, it is positive and significant in the other two regression models. Again, this is undoubtedly capturing other local influences. Likewise, proximity to a Superfund site exerts a positive and significant influence in Butler county. Being within ¼ mile of a lake or river significantly increases home prices in Trumbull county (i.e., by 4.1%) whereas they significantly decrease them in Middlesex (i.e., by 2%). This latter finding may be reflecting negative consequences associated with proximity to rivers, such as flooding. Unfortunately, residence in floodplains is not controlled in the regression models.

Turning to fiscal measures, a high property tax burden depresses housing prices in Niles. Specifically, a 1% increase in the tax rate leads to a 3.8% reduction in the sale price of the property, The school district exerts a relatively strong influence on real home prices in Trumbull county. For example, housing price difference are as large as 98% between the lowest and the highest valued school districts in the county. Finally, the dummy variables for the jurisdiction in the Trumbull and Middlesex counties are statistically significant.

Time and Seasonal Dummy Variables

Seasonal dummy variables show that housing prices in Butler county are significantly higher in the fall, than the winter (i.e., the omitted category) whereas they are significantly higher in the summer in Middlesex. In addition, real housing prices have risen over the 1988-1 997 time period, with the real appreciation rate approximately 26% in Butler county, and 28% in Trumbull. The influence of the mild recession in 1990-9 1 is indicated by a slight decline in real housing prices (i.e., - 1%) between 1990 and 199 1 in Butler county and insignificant changes in 1989 and 1990 (as compared to 1988) in Trumbull county. The situation in Middlesex is somewhat stronger, with real price appreciation of 2 11% over the 11 year period. This is in spite of a relatively deep recession in New England during the late 1980's. .

Railroad Related Variables: Specification 1

Turning to the findings on railroad variables in the first specification, controls for proximity to both Conrail and other rail lines consistently reveals that properties with 1000 feet of a rail line experience significantly lower home sale prices. The reductions for properties along Conrail lines are between 4.7% and 5.9%, whereas they are somewhat higher along other lines (i.e., about

5.8% in Trumbull county; 13.3% in Butler county, and 7.7% in Middlesex county). These differences may be due to different activity levels along the different rail lines. Unfortunately, activity levels along each section of track were not available. Turning to the impact areas surrounding the crossings, some patterns do emerge although there are some exceptions as well. Specifically, an examination of the baseline effects in the moderate impact area of Conrail crossings reveals significantly lower home sale prices in the impact area for Ohio properties. Indeed, they are 6.8% lower in the Butler moderate impact area (as compared to outside the area) and 7.7% lower in the Trumbull county moderate area. However, we find just the opposite baseline effect for Middlesex county with 6.2% higher property values within the moderate impact zone. One might suspect that some of the crossings in Middlesex county are also rail stations for public transit. However, the activity levels are too low at those crossings for that to be the case. For other lines, there are even similar negative baseline effects in Ohio (-7.7% in Butler and -12.5% in Trumbull). The severe impact areas for Conrail crossings are negative and significant for the Trumbull county, and as expected, the negative impact is greater in the severe impact area (i.e., -19.3% as compared to -7.7% in the moderate zone). The coefficient on the Conrail severe impact area is negative though not significant in Butler county, and positive, but again insignificant for Middlesex. Finally, the only coefficient that is significant among those in the severe impact area (other) category is for Middlesex county, which experiences 14.3% lower sales prices than those outside the impact area.

Examining the effect of the Conrail action, there is some indication that housing prices were detrimentally impacted. Specifically, housing prices were 6.7% in the moderate zone of Butler county as a result of the action. However, the decline appears to be temporary since the coefficient on the interaction term with Days Since the action was positive and significant. Over time, real housing prices rose about 2.3% per year in the moderate zone, which implies the detrimental impact would be eliminated in just under 3 years. A similar pattern emerges for the severe zone in Butler county, although only the coefficient on the Days Since interaction term is statistically significant[7].

Railroad Related Variables: Specification 2

The second specification estimates continuous price-distance gradients, which measure the rate at

[7] Note that activity levels at these crossings are not controlled. Although information was collected from the Federal Railroad Administration on activity levels at the crossings, these data were not consistently defined over time. Furthermore, of the three areas considered, only Middlesex county had activity levels that exceeded 50 trains per 24 hour period, which is the threshold activity level identified by Sorensen and Hammer (1983) as they measured annoyance levels among residents. When we did include controls for high activity levels in Middlesex county, the activity interaction terms were all insignificant and none of the other coefficients changed appreciably.

which housing prices change with the distance of the property from the rail line or rail crossing. The findings are similar in many respects to those found in the previous specification, but there are some important differences as well. The coefficient estimates on the line impact dummy variables consistently reveal negative and significant property value impacts. For Conrail lines, the price reductions range from about 9.5% in Butler and Middlesex counties to 25.8% in Trumbull county. For other rail lines, real home prices are significantly reduced 14.3% in Butler county and -16.9% in Middlesex county. While these values are larger in magnitude than those found in the first specification, there is an important difference in the interpretation. For the first specification, no gradient was estimated. Hence the coefficient on the line impact area variable represented the average impact over the entire impact area. In this specification, the line impact area dummy variable is also interacted with the distance of the property from the line. Thus, the interpretation of the coefficient on LIA is now interpreted as the impact at the closest point to the rail line, rather than the average impact over the entire impact area. The interaction between LIA and distance measures the marginal effect of distance from the rail line, within the Line Impact Area. Two of the six gradients are positive and significant implying that property values significantly increase with distance from the rail line. Since distance is denominated in miles, the findings imply that an additional 100 feet from the Conrail track (i.e., 0.0189 miles) increases property values 0.9% in Butler County and 2.8% in Trumbull.

Turning to the analysis of rail crossings there are some surprising results. For other rail lines, the coefficient on the Crossing Impact Area (CIA) in Butler county is positive and significant. That is, real home prices are 10.2% higher for properties at located at the edge of the track. In addition, the housing price-distance relationship is negative implying that within the impact area, housing prices fall about 1% per additional 100 feet from the track.. For Middlesex county, the coefficient on CIA for other rail lines does take on the expected negative sign (i.e., -14.3%), and the gradient is positive (i.e., prices rise 0.8% per additional 100 from the track). However, neither coefficient is statistically significant, although t-scores exceed 1.4 on both coefficients. The only group of coefficients that are statistically significant for Conrail crossings are those in Butler county. The coefficient estimate on the CIA dummy variable is negative and statistically significant, implying that property prices at the edge of the track are 9.6% lower than those outside the CIA. Furthermore, the coefficient on the interaction term with distance is positive but it is not significant. This implies that property prices don't appear to vary with distance, at least in the period prior to the Conrail action. However, the coefficient estimates on the CIA * Ignore * Distance is negative with a t-score approaching significance at the 90% level. This suggests that immediately following the action, the distance gradient actually flattened slightly (i.e., by 0.3% per 100 feet). However, coefficient on the term that interacts distance with the days since the action (i.e., CIA*Ignore*Days Since*Distance) is positive and significant. This implies that the gradient becomes more positive over time following the action by Conrail. However, the magnitude of the change is minuscule, as housing prices rise only 0.03% for each 100 feet from the track, or 0.3% over the entire 1000 foot impact area. Thus, on net, real prices are significantly lower in the Conrail CIA of Butler county, and they change very little spatially, and there is no evidence to suggest that the Conrail action appreciably influenced property prices.

V. Conclusions and Policy Implications.

This study analyze the residential property markets in three different geographic areas which had whistle bans in place prior to the policy action taken by Conrail in October, 1991. Hedonic housing price models were developed using data on more than 20,000 home sales in three different geographic areas; Butler county in southwestern Ohio, Niles county in northeastern Ohio, and Middlesex county in eastern Massachusetts. After controlling for a wide range of structural features of the property and locational attributes of the neighborhood surrounding the property, the impact of the Conrail action was investigated using two different specifications. The findings consistently show that proximity to rail lines has a negative and statistically important influence on residential property values. In addition, there is also evidence that proximity to rail crossings can reduce the real sale price of homes, although there is also evidence to the contrary. All of these impacts existed prior to the point at which Conrail began ignoring the train whistle bans in these three areas. However, there is little support for the contention that the decision by Conrail to begin ignoring whistle bans had any permanent and appreciable influence on the housing values in these communities. In the only area where a negative effect was identified, property prices rebounded within about 3 years.

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 whistles will be blown at the crossing in the future. Thus, when Conrail began ignoring the ban, it may have only confirmed their initial suspicions. Furthermore, it is likely that the Conrail action generated dynamic changes in the composition of residents which served to mitigate the initial impact of the action. Residents most sensitive to train whistle noise would be expected to eventually move away from the impacted area, and they would be replaced with those less bothered by train whistles. This is because the residents most tolerant of train noise would have the highest willingness to pay for the property when it is on the market. This transition from more sensitive to less sensitive residents does not happen immediately. However, the evidence presented in this study suggests that any detrimental impact from train whistle noise is eliminated within 3 years.

This study does have important implications for policy makers. First, it suggests that concerns voiced by residents with concerns about potential property market impacts from train whistle noise are justified, at least in the short run. Property markets appear to efficiently incorporate the level of neighborhood attributes into housing prices. This process, known as capitalization, implies that policy actions that lead to more train whistle noise have the potential to reduce housing prices for residents within the audible range of the train crossing in the short run. Second, the results also imply that there is a dynamic process in the housing market that leads to smaller long run as compared to short run impacts.

Care should be taken in extrapolating these findings to other areas. As these findings indicate, there are some consistent findings across the three study areas, especially in regards to the effects of proximity to rail lines. However, some areas experienced no impact from the Conrail action to ignore whistle bans, whereas others displayed short-run detrimental effects. Furthermore, it should be noted that none of the geographic areas considered in this study experienced extremely high volumes of train traffic. For example, surveys of residents in the vicinity of train noise show that annoyance levels rise with frequency and timing of trains. Findings in low traffic communities are not representative of those experiencing much higher train activity.

These findings, while enlightening, are just a first step in understanding how train whistles influence local property markets. More complete data is needed to achieve a thorough understanding of the factors leading to residential property price impacts of train whistles. This includes data on train activity levels that is continuously defined. In addition, more complete noise impact areas, which incorporate distance, terrain, and the presence of other factors such as tall buildings which can serve as barriers to noise, need to be developed and applied to property sales in the vicinity of train crossings. Finally, this study has focused on property impacts from train whistles. There are other impacts that could also be investigated, including the influence on residential mobility. That is, does a change in policy regarding train noise motivate some residents to move out of the audible range of trains. Although this study suggests that this dynamic process may be at work, more direct measures of mobility are needed before strong conclusions can be drawn.

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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_{BUTLER}=6971, $N_{TRUMBULL}$=5064, $N_{MIDDLESEX}$=8986	Source	Predicted Sign
Real Price	Real sale price of the property (1990 dollars) [μ_{BUTLER} =66846.52, σ_{BUTLER}=36284.43] [$\mu_{TRUMBULL}$=57448.85, $\sigma_{TRUMBULL}$=34760.24] [$\mu_{MIDDLESEX}$ =154373.50, $\sigma_{MIDDLESEX}$=94787.99]	Dataquick or Experían nominal price divided by the national CPI for housing	lnRPRICE is the dependent variable
Age house	Age of the house in years. [μ_{BUTLER} =43.076,σ_{BUTLER}=27.191] [$\mu_{TRUMBULL}$=39.156, $\sigma_{TRUMBULL}$=24.226] [$\mu_{MIDDLESEX}$ =37.827, $\sigma_{MIDDLESEX}$=27.892]	Dataquick Experían	?
Bathrooms (OH) Half baths (MA) Full baths (MA)	Sum of full and half baths, where each full bath=1 and each half bath=0.5. Bathrooms: [μ_{BUTLER} =1.500, σ_{BUTLER}=0.633] Bathrooms: [$\mu_{TRUMBULL}$=1.455, $\sigma_{TRUMBULL}$=0.577] Half baths: [$\mu_{MIDDLESEX}$ =0.532, $\sigma_{MIDDLESEX}$=0.545] Full baths: [$\mu_{MIDDLESEX}$ =1.569, $\sigma_{MIDDLESEX}$=0.653]	Dataquick Experían	+
Bedrooms	Number of bedrooms in house [μ_{BUTLER} =2.885, σ_{BUTLER}=0.703] [$\mu_{TRUMBULL}$=3.002, $\sigma_{TRUMBULL}$=0.630] [$\mu_{MIDDLESEX}$ =3.289, $\sigma_{MIDDLESEX}$=0.781]	Dataquick Experían	+
Other rooms	Total rooms minus number of bedrooms [μ_{BUTLER} =3.073, σ_{BUTLER}=0.990] [$\mu_{TRUMBULL}$=3.053, $\sigma_{TRUMBULL}$=0.881] [$\mu_{MIDDLESEX}$ =3.783, $\sigma_{MIDDLESEX}$=0.958]	Dataquick Experían	+
Fireplace	Number of fireplaces in the house [μ_{BUTLER} =0.458, σ_{BUTLER}=0.498] [$\mu_{TRUMBULL}$=0.306, $\sigma_{TRUMBULL}$=0.461] [$\mu_{MIDDLESEX}$ =1.103, $\sigma_{MIDDLESEX}$=0.787]	Dataquick Experían	+
Number of stories	Number of stories in the property [μ_{BUTLER} =1.367, σ_{BUTLER}=0.506] [$\mu_{TRUMBULL}$=1.584, $\sigma_{TRUMBULL}$=0.531] [$\mu_{MIDDLESEX}$ =1.379, $\sigma_{MIDDLESEX}$=0.654]	Dataquick Experían	?

Variable Name	Definition [mean, standard deviation] N_{BUTLER}=6971, $N_{TRUMBULL}$=5064, $N_{MIDDLESEX}$=8986	Source	Predicted Sign
Pool	1=Presence of a pool, 0=otherwise. (OH only) [μ_{BUTLER} =0.023, σ_{BUTLER}=0.150] [$\mu_{TRUMBULL}$=0.085, $\sigma_{TRUMBULL}$=0.278]	Dataquick	?
Building area	Structure area in square feet.. [μ_{BUTLER} =1386.535, σ_{BUTLER}=564.664] [$\mu_{TRUMBULL}$=1464.757, $\sigma_{TRUMBULL}$=569.502] [$\mu_{MIDDLESEX}$ =1874.657, $\sigma_{MIDDLESEX}$=819.616]	Dataquick Experían	+
Garage area	Garage area in square feet. (OH only) [μ_{BUTLER} =262.078, σ_{BUTLER}=248.098] [$\mu_{TRUMBULL}$=353.136, $\sigma_{TRUMBULL}$=235.575]	Dataquick	+
Lot area	Lot area in square feet. [μ_{BUTLER} =20716.730, σ_{BUTLER}=54621.570] [$\mu_{TRUMBULL}$=20797.380, $\sigma_{TRUMBULL}$=80574.35] [$\mu_{MIDDLESEX}$ =31306.25, $\sigma_{MIDDLESEX}$=52842.21]	Dataquick Experían	+

Variables in the *Neighborhood* Category

Variable Name	Definition [mean, standard deviation] N_{BUTLER}=6971, $N_{TRUMBULL}$=5064, $N_{MIDDLESEX}$=8986	Source	Predicted Sign
Air quality monitor distance	Distance weighted value of the nearest air quality monitor. [μ_{BUTLER} =2.109, σ_{BUTLER}=1.773] [$\mu_{TRUMBULL}$=3.514, $\sigma_{TRUMBULL}$=1.098] [$\mu_{MIDDLESEX}$ =6.079, $\sigma_{MIDDLESEX}$=2.274]	EPA-AIRS AQS database	-
Airport 3 miles Distance to airport	AIRPT3MI=1 if property within 3 miles of the airport. 0=otherwise [μ_{BUTLER}=0.604, σ_{BUTLER}=0.489] [$\mu_{TRUMBULL}$=0.123, $\sigma_{TRUMBULL}$=0.328] [$\mu_{MIDDLESEX}$ =0.042, $\sigma_{MIDDLESEX}$=0.201] Distance to the closest airport. [μ_{BUTLER} =3.145, σ_{BUTLER}=1.906] [$\mu_{TRUMBULL}$=6.053, $\sigma_{TRUMBULL}$=1.536] [$\mu_{MIDDLESEX}$ =6.651, $\sigma_{MIDDLESEX}$=2.000]	FAA, ArcView computed.	

Variable Name	Definition [mean, standard deviation] $N_{BUTLER}=6971$, $N_{TRUMBULL}=5064$, $N_{MIDDLESEX}=8986$	**Source**	Predicted **Sign**
Highway ¼ mile	Highway ¼ mile=1 if property is within quarter mile of highway, 0=otherwise. [μ_{BUTLER} = 0.004, σ_{BUTLER}=0.063] [$\mu_{TRUMBULL}$=0.040, $\sigma_{TRUMBULL}$=0.195] [$\mu_{MIDDLESEX}$ =0.074, $\sigma_{MIDDLESEX}$=0.261]	ArcView computed	
Distance	Distance of highway from property in miles [μ_{BUTLER}=3.441, σ_{BUTLER}=2.012] [$\mu_{TRUMBULL}$=3.830, $\sigma_{TRUMBULL}$=2.471] [$\mu_{MIDDLESEX}$ =1.783, $\sigma_{MIDDLESEX}$=1.484]		
Lake/River	1=lake, river or stream within 0.25 miles of the property, 0 otherwise. [μ_{BUTLER} =0.181, σ_{BUTLER}=0.385] [$\mu_{TRUMBULL}$=0.104, $\sigma_{TRUMBULL}$=0.305] [$\mu_{MIDDLESEX}$ =0.559, $\sigma_{MIDDLESEX}$=0.496]	ArcView computed	
Median HH income	Median household income of the census block group [μ_{BUTLER} =33045.88, σ_{BUTLER}=11963.82] [$\mu_{TRUMBULL}$=32374.60, $\sigma_{TRUMBULL}$=9972.051] [$\mu_{MIDDLESEX}$ =61623.44, $\sigma_{MIDDLESEX}$= 19.077]	Census STF-3A	+
Median year built	Median year the houses in the census block group were built. [μ_{BUTLER} =1957.956, σ_{BUTLER}=12.960] [$\mu_{TRUMBULL}$=1959.035, $\sigma_{TRUMBULL}$=11.959] [$\mu_{MIDDLESEX}$ =1954.593, $\sigma_{MIDDLESEX}$=27.631]		
%Asian	Percent of census block group population that is Asian or pacific islander. [μ_{BUTLER} =0.309, σ_{BUTLER}=0.536] [$\mu_{TRUMBULL}$=0.657, $\sigma_{TRUMBULL}$=1.185] [$\mu_{MIDDLESEX}$ =2.695, $\sigma_{MIDDLESEX}$=2.661]	Census STF-3A	?
%Black	Percent of census block group population that is black. [μ_{BUTLER} =4.652, σ_{BUTLER}=13.477] [$\mu_{TRUMBULL}$=2.846, $\sigma_{TRUMBULL}$=7.342] [$\mu_{MIDDLESEX}$ =1.615, $\sigma_{MIDDLESEX}$=2.019]	Census STF-3A	?

Variable Name	Definition [mean, standard deviation] N_{BUTLER}=6971, $N_{TRUMBULL}$=5064, $N_{MIDDLESEX}$=8986	Source	Predicted Sign
%Hispanic	Percent of census block group population that is Hispanic [μ_{BUTLER} =0.378, σ_{BUTLER}=0.485] [$\mu_{TRUMBULL}$ =0.786, $\sigma_{TRUMBULL}$=0.555] [$\mu_{MIDDLESEX}$ =1.938, $\sigma_{MIDDLESEX}$=3.075]	Census STF-3A	?
%Occupied units	Percent of census block group housing units that are occupied. [μ_{BUTLER} =96.005, σ_{BUTLER}=2.941] [$\mu_{TRUMBULL}$ =98.449, $\sigma_{TRUMBULL}$=2.624] [$\mu_{MIDDLESEX}$ =96.710, $\sigma_{MIDDLESEX}$=2.889]	Census STF-3A	+
%Owner occupied	Percent of census block group housing units that are owner-occupied. [μ_{BUTLER} =73.836, σ_{BUTLER}=20.180] [$\mu_{TRUMBULL}$ =79.092, $\sigma_{TRUMBULL}$=11.00214.386] [$\mu_{MIDDLESEX}$ =84.614, $\sigma_{MIDDLESEX}$=13.971]	Census STF-3A	+
Population density	Population density in the census block group, measured as people per square mile. [μ_{BUTLER} =3494.280, σ_{BUTLER}=2823.632] [$\mu_{TRUMBULL}$ =2762.478, $\sigma_{TRUMBULL}$=2132.853] [$\mu_{MIDDLESEX}$ =2299.807, $\sigma_{MIDDLESEX}$=1893.186]	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: TRUMBULL has no properties within 3 miles of a Superfund site.* [μ_{BUTLER} =0.0005, σ_{BUTLER}=0.024] [$\mu_{MIDDLESEX}$ =0.614, $\sigma_{MIDDLESEX}$=0.487]	Landview II	-
Tax rate	tax payment /assessed value. [μ_{BUTLER} =4.051, σ_{BUTLER}=0.464] [$\mu_{TRUMBULL}$ =4.188, $\sigma_{TRUMBULL}$=0.841] [$\mu_{MIDDLESEX}$ =0.015, $\sigma_{MIDDLESEX}$=0.005]	Dataquick Experían	-
Toxic Release Inventory	Distance to closest Toxic Release Inventory site [μ_{BUTLER} =1.311, σ_{BUTLER}=1.109] [$\mu_{TRUMBULL}$ =1.619, $\sigma_{TRUMBULL}$=1.098] [$\mu_{MIDDLESEX}$ =1.468, $\sigma_{MIDDLESEX}$=0.899]	Landview II	

Variable Name	Definition [mean, standard deviation] N_{BUTLER}=6971, $N_{TRUMBULL}$=5064, $N_{MIDDLESEX}$=8986	Source	Predicted Sign
Commute time	Average household travel time to work in the census block group in minutes. [μ_{BUTLER} =20.649, σ_{BUTLER}=2.961] [$\mu_{TRUMBULL}$ =18.866, $\sigma_{TRUMBULL}$=2.287] [$\mu_{MIDDLESEX}$ =27.237, $\sigma_{MIDDLESEX}$=3.200]	Census STF-3A	
Power plant	1=presence of power plant within 3 miles of property, 0=otherwise. (OH only, MA beyond 3 miles) [μ_{BUTLER} =0.001, σ_{BUTLER}=0.029] [$\mu_{TRUMBULL}$=0.463, $\sigma_{TRUMBULL}$=0.499] Distance of power plant to the property in miles [μ_{BUTLER} =9.429, σ_{BUTLER}=1.225] [$\mu_{TRUMBULL}$=3.567, $\sigma_{TRUMBULL}$=2.126]	ArcView computed	?
School Dummy variables	1=dwelling lies with school district i (where i=8 for BUTLER, and i=13 for TRUMBULL), 0=otherwise. *Mean values reported.* [$\mu_{BUTLER,1}$=0.001, $\mu_{BUTLER,2}$=0.095, $\mu_{BUTLER,3}$=0.078, $\mu_{BUTLER,4}$=0.074] [$\mu_{TRUMBULL,1}$=0.146, $\mu_{TRUMBULL,2}$=0.252, $\mu_{TRUMBULL,3}$=0.088, $\mu_{TRUMBULL,4}$=0.001 $\mu_{TRUMBULL,5}$=0.006, $\mu_{TRUMBULL,6}$=0.002, $\mu_{TRUMBULL,7}$=0.018, $\mu_{TRUMBULL,8}$ =0.006, $\mu_{TRUMBULL,9}$=0.006, $\mu_{TRUMBULL,10}$=0.006, $\mu_{TRUMBULL,11}$=0.050, $\mu_{TRUMBULL,12}$=0.027, $\mu_{TRUMBULL,13}$=0.001, $\mu_{TRUMBULL,14}$=0.059, $\mu_{TRUMBULL,15}$=0.002, $\mu_{TRUMBULL,16}$=0.010, $\mu_{TRUMBULL,17}$=0.043] [$\mu_{MIDDLESEX}$ =0.117, $\mu_{MIDDLESEX}$ =0.021, $\mu_{MIDDLESEX}$=0.430, $\mu_{MIDDLESEX}$ =0.277]	Wessex	?

Variable Name	Definition [mean, standard deviation] N_{BUTLER}=6971, $N_{TRUMBULL}$=5064, $N_{MIDDLESEX}$=8986	Source	Predicted Sign
City Dummy variables	1=dwelling lies within specific city political boundaries, 0 otherwise. *Mean values reported.* For Butler, jurisdictions are Monroe, Trenton and Middletown. [$\mu_{MIDDLETOWN}$=0.852, μ_{MONROE}=0.059 $\mu_{TRENTON}$=0.089] For Trumbull, jurisdictions are Girard, Niles, Mineral Ridge, McDonald and Warren. [μ_{GIRARD}=0.201, μ_{NILES}=0.280, $\mu_{MINERAL\ RIDGE}$=0.032, $\mu_{MCDONALD}$=0.065 μ_{WARREN}=0.422] For Middlesex, jurisdictions are Ashland, Framingham, Natick, Sherborn, Sudbury and Wayland. [$\mu_{ASHLAND}$=0.084, $\mu_{FRAMINGHAM}$ =0.391 μ_{NATICK}=0.315, $\mu_{SHERBORN}$=0.057 $\mu_{SUDBURY}$=0.0002 $\mu_{WAYLAND}$=0.153]	Dataquick Experían	? Omitted category in Butler is Middletown; omitted category in Trumbull is Warren; omitted category in Middlesex is Framingham.

Time Related Variables

Variable Name	Definition [mean values] N_{BUTLER}=6971, $N_{TRUMBULL}$=5064, $N_{MIDDLESEX}$=8986	Source	Predicted Sign
Seasonal Dummy variables	*Mean values only* Spring= 1 (March-May), 0=otherwise [μ_{BUTLER} =0.283, $\mu_{TRUMBULL}$=0.275, $\mu_{MIDDLESEX}$=0.246] Summer=1 (June-Aug), 0=otherwise [μ_{BUTLER} =0.292, $\mu_{TRUMBULL}$=0.304, $\mu_{MIDDLESEX}$=0.343] Fall= 1 (Sept-Nov), 0=otherwise [μ_{BUTLER}=0.237, $\mu_{TRUMBULL}$=0.233, $\mu_{MIDDLESEX}$=0.231] Winter= 1 (Dec-Feb), 0=otherwise [μ_{BUTLER} =0.188, $\mu_{TRUMBULL}$=0.188, $\mu_{MIDDLESEX}$=0.220] .	Dataquick Experían	Spring ? Summer ? Fall ? Winter is left out variable
YEARi (i=1988,...,1997)	*Mean values only* 1=dwelling sold in i[th] year, 0 otherwise [$\mu_{BUTLER,88}$ =0.081, $\mu_{BUTLER,89}$ =0.084, $\mu_{BUTLER,90}$ =0.095, $\mu_{BUTLER,91}$ =0.090, $\mu_{BUTLER,92}$ =0.105, $\mu_{BUTLER,93}$= 0.120, $\mu_{BUTLER,94}$ =0.102, $\mu_{BUTLER,95}$ =0.118, $\mu_{BUTLER,96}$ =0.125, $\mu_{BUTLER,97}$ =0.080] [$\mu_{TRUMBULL,88}$=0.078, $\mu_{TRUMBULL,89}$=0.093, $\mu_{TRUMBULL,90}$=0.102, $\mu_{TRUMBULL,91}$=0.098, $\mu_{TRUMBULL,92}$=0.115, $\mu_{TRUMBULL,93}$=0.137, $\mu_{TRUMBULL,94}$=0.137, $\mu_{TRUMBULL,95}$=0.136, $\mu_{TRUMBULL,96}$=0.079, $\mu_{TRUMBULL,97}$=0.007] [$\mu_{MIDDLESEX,86}$=0.061,$\mu_{MIDDLESEX,87}$=0.045, $\mu_{MIDDLESEX,88}$=0.053, $\mu_{MIDDLESEX,89}$=0.050 $\mu_{MIDDLESEX,90}$=0.054, $\mu_{MIDDLESEX,91}$=0.086, $\mu_{MIDDLESEX,92}$=0.107, $\mu_{MIDDLESEX,93}$=0.118, $\mu_{MIDDLESEX,94}$=0.122, $\mu_{MIDDLESEX,95}$=0.107, $\mu_{MIDDLESEX,96}$=0.124, $\mu_{MIDDLESEX,97}$=0.073]	Dataquick Experían	? 1988 is omitted category in OH data, 1986 is omitted category in MA data.

Variables in the *Railroad* Category

Variable Name	Definition [mean, standard deviation] N_{BUTLER}=6971, $N_{TRUMBULL}$=5064, $N_{MIDDLESEX}$=8986	Source	Predicted Sign
Line Impact Area (LIA)	1 = Conrail line within 1000 feet of the property, 0=otherwise. [μ_{BUTLER} =0.147, σ_{BUTLER}=0.354] [$\mu_{TRUMBULL}$=0.054, $\sigma_{TRUMBULL}$=0.226] [$\mu_{MIDDLESEX}$ =0.121, $\sigma_{MIDDLESEX}$=0.326] 1 = Other rail crossing within 2820 feet of the property, 0=otherwise. [μ_{BUTLER} =0.094, σ_{BUTLER}=0.291] [$\mu_{TRUMBULL}$ =0.049, $\sigma_{TRUMBULL}$=0.216] [$\mu_{MIDDLESEX}$ =0.016, $\sigma_{MIDDLESEX}$=0.128]	Computed from FRA crossing database.	-
Distance from Rail Line	Distance of the property from Conrail line in miles [μ_{BUTLER} =1.161, σ_{BUTLER}=1.234] [$\mu_{TRUMBULL}$=1.359, $\sigma_{TRUMBULL}$=1.096] [$\mu_{MIDDLESEX}$ =0.992, $\sigma_{MIDDLESEX}$=0.992] Distance of the property from other rail line in miles. [μ_{BUTLER} =1.291, σ_{BUTLER}=1.090] [$\mu_{TRUMBULL}$=1.304, $\sigma_{TRUMBULL}$=1.145] [$\mu_{MIDDLESEX}$ =3.160, $\sigma_{MIDDLESEX}$=1.400]	Computed from FRA database	+
Crossing Impact Area (CIA)	1 = Conrail crossing within 2320 feet of the property, 0=otherwise. [μ_{BUTLER} =0.229, σ_{BUTLER}=0.420] [$\mu_{TRUMBULL}$ =0.101, $\sigma_{TRUMBULL}$=0.301] [$\mu_{MIDDLESEX}$ =0.098, $\sigma_{MIDDLESEX}$=0.297] 1= Other rail crossing within 2320 feet of the property, 0=otherwise. [μ_{BUTLER} =0.123, σ_{BUTLER}=0.329] [$\mu_{TRUMBULL}$ =0.038, $\sigma_{TRUMBULL}$=0.191] [$\mu_{MIDDLESEX}$ =0.028, $\sigma_{MIDDLESEX}$=0,167]	Computed from FRA database	-

Variable Name	Definition [mean, standard deviation] N_{BUTLER}=6971, $N_{TRUMBULL}$=5064, $N_{MIDDLESEX}$=8986	Source	Predicted Sign
Severe Impact Area	1 = Conrail crossing within 1000 feet of the property, 0=otherwise. [μ_{BUTLER} =0.058,σ_{BUTLER}=0.233] [$\mu_{TRUMBULL}$=0.017, $\sigma_{TRUMBULL}$=0.131] [$\mu_{MIDDLESEX}$ =0.023, $\sigma_{MIDDLESEX}$=0.150] 1= Other rail crossing within 1000 feet of the property, 0=otherwise. [μ_{BUTLER} =0.034,σ_{BUTLER}=0.181] [$\mu_{TRUMBULL}$=0.005, $\sigma_{TRUMBULL}$=0.074] [$\mu_{MIDDLESEX}$ =0.006, $\sigma_{MIDDLESEX}$=0.078]	Computed from FRA database	-
Moderate Impact Area	1 = Conrail crossing between 1000 and 2320 feet of the property, 0=otherwise. [μ_{BUTLER} =0.171,σ_{BUTLER}=0.376] [$\mu_{TRUMBULL}$=0.084, $\sigma_{TRUMBULL}$=0.276] [$\mu_{MIDDLESEX}$ =0.075, $\sigma_{MIDDLESEX}$=0.263] 1= Other rail crossing between 1000 and 2320 feet of the property, 0=otherwise. [μ_{BUTLER} =0.089,σ_{BUTLER}=0.285] [$\mu_{TRUMBULL}$=0.032, $\sigma_{TRUMBULL}$=0.177] [$\mu_{MIDDLESEX}$ =0.022, $\sigma_{MIDDLESEX}$=0.148]	Computed from FRA database	-
Distance from rail crossing	Distance of the property from the Conrail rail crossing in miles. [μ_{BUTLER} = 1.369,σ_{BUTLER}= 1.102] [$\mu_{TRUMBULL}$=1.586, $\sigma_{TRUMBULL}$=0.068] [$\mu_{MIDDLESEX}$ =1.337, $\sigma_{MIDDLESEX}$=0.864] Distance of the property from the other rail crossing in miles. [μ_{BUTLER} =1.595,σ_{BUTLER}=1.051] [$\mu_{TRUMBULL}$=2.233, $\sigma_{TRUMBULL}$=1.309] [$\mu_{MIDDLESEX}$ =2.330, $\sigma_{MIDDLESEX}$=1.312]	Computed from FRA database	+
Ignore	1=property sold more than 45 days after the decision by Conrail to ignore the whistle ban, 0=otherwise. [μ_{BUTLER} =0.653, σ_{BUTLER}=0.476] [$\mu_{TRUMBULL}$=0.614, $\sigma_{TRUMBULL}$=0.487] [$\mu_{MIDDLESEX}$ =0.656, $\sigma_{MIDDLESEX}$=0.475]	Computed from FRA database	+

Variable Name	Definition [mean, standard deviation] N_{BUTLER}=6971, $N_{TRUMBULL}$=5064, $N_{MIDDLESEX}$=8986	Source	Predicted Sign
Days Since	The number of days since the whistle ban was ignored. [μ_{BUTLER} =700.244, σ_{BUTLER}=704.097] [$\mu_{TRUMBULL}$ =549.426, $\sigma_{TRUMBULL}$=577.750] [$\mu_{MIDDLESEX}$ =699.206, $\sigma_{MIDDLESEX}$=696.599]	Computed from FRA database	-

Table 3: Hedonic Regression Examining Effect of Conrail Action on Impact Zones
Dependent Variable: Log of Real Price

	Butler County		Trumbull County		Middlesex County	
Variable	*Coefficient*	*t-stat.*	*Coefficient*	*t-stat.*	*Coefficient*	*t-stat.*
Intercept	-0.22284	-0.151	8.66759	5.441	416.2352	2.038
	Structural Characteristics					
Age house	-0.00322	-3.664	0.00027	0.235	-0.20904	-2.029
Age house squared	-5.53E-06	-0.755	-4.90E-05	-4.131	2.07E-05	5.971
Bathrooms (OH) Full bath (MA)	0.027058	2.4845	0.108748	7.557	0.082223	7.892
Half bath (MA)					0.081115	8.819
Bedrooms	0.032142	3.555	0.042276	4.078	0.009412	1.237
Other rooms	0.016642	3.1265	0.031686	3.667	0.007968	1.399
Fire place	0.132343	13.969	0.11851	9.329	0.061938	7.95
Garage area	0.000177	8.2822	0.000387	6.956		
Garage area squared	-5.04E-08	-4.832	-1.55E-07	-2.212		
Building area	0.00035	11.034	0.000453	7.571	0.000275	8.583
Building area squared	-2.67E-08	-4.135	-5.34E-08	-3.459	-2.47E-08	-4.162
Lot area	5.46E-07	3.7904	2.34E-08	0.501	6.44E-07	2.942
Number of stories	-0.01874	-1.793	-0.06586	-4.503	0.056795	5.94
Pool	0.084993	4.9757	0.073228	4.639		
	Structural Characteristics					
Airport 3 miles	0.17256	5.0854	-0.29146	-2.42	-0.10534	-0.952
Airport 3 miles * distance	-0.05185	-4.432	0.102091	2.863	0.025275	0.543
Highway quarter mile	-0.16597	-0.576	-0.1351	-1.496	-0.07098	-2.097
Highway quarter mile * distance	0.928794	0.6857	0.540062	1.081	0.405387	2.089
% Owner occupied	0.003034	6.2207	-0.00252	-3.713	0.003532	1.798
% Occupied	-0.00218	-1.168	-0.01161	-3.902	-0.00315	-6.822
% Asian	0.003504	0.3971	-0.01499	-2.067	-0.00454	-3.089
% Black	-0.00507	-12.31	-0.00734	-7.422	-0.00092	-0.391
% Hispanic	-0.00533	-0.557	-0.04239	-3.501	0.00168	1.243
Median HH income	5.89E-06	6.1544	1.27E-05	8.71	4.10E-06	9.184
Commute time	-0.01271	-6.347	0.00365	1.282	-0.00081	-0.491
Population density	2.85E-06	0.9149	8.69E-06	2.192	-1.29E-06	-0.53
Median year built	0.005305	7.1279	0.001063	1.309	-0.20458	-1.989
Superfund within 3 miles	0.563635	2.0153			-0.01483	-1.322
Lake/River	-0.00782	-0.685	0.040776	2.04	-0.02015	-2.428
Tax rate	0.046613	1.4078	-0.03865	-3.639	0.468581	1.608
Air quality monitor distance	-0.00023	-0.022	-0.01332	-1.622	0.01402	2.35
Toxic Release Inventory	-0.02276	-1.816	0.077225	5.268	0.061305	7.238
Power plant 3 miles	-0.49905	-0.401	0.037878	0.637		
Power plant 3 miles * distance	3.36E-05	0.3221	-0.00392	-0.183		
	City Dummy Variables					
City dummy 1	-0.00259	-0.109	-0.34919	-2.659	0.892408	1.77
City dummy 2	0.07609	1.3636	-0.15271	-1.308	0.08072	1.583
City dummy 3			-0.15456	-2.164	0.099351	1.805
City dummy 4			-0.03817	-0.801	0.052274	1.674
City dummy 5					0.188945	4.793
	School District Dummy Variables					
School district 1	-0.05079	-0.28	0.430313	3.106	-0.01091	-0.471
School district 2	0.044547	0.6749	0.082412	1.816	-0.14266	-3.339

Table 3: Hedonic Regression Examining Effect of Conrail Action on Impact Zones (continued)

	Butler County		Trumbull County		Middlesex County	
Variable	*Coeffici*	*t-stat*	*Coeffici*	*t-stat*	*Coefficient*	*t-stat*
School district 3	0.062722	1.8127	0.090162	3.172	0.000744	0.032
School district 4	0.082184	1.828	0.47816	2.552	0.068579	2.775
School district 5			0.10145	1.106		
School district 6			-0.42195	-1.875		
School district 7			-0.03473	-0.546		
School district 8			0.049769	0.431		
School district 9			0.033439	0.399		
School district 10			0.461231	3.339		
School district 11			0.01634	0.389		
School district 12			-0.51784	-3.027		
School district 13			0.20809	1.756		
School district 14			0.03941	0.24		
School district 15			0.146185	2.098		
School district 16			0.152631	2.51		
Time Related Dummy Variables						
Spring	0.011324	1.0173	-0.01394	-0.956	0.009582	0.728
Summer	0.010086	0.9105	0.016061	1.154	0.050988	4.351
Fall	0.020967	1.7993	0.007328	0.5	-0.00548	-0.398
Year 1987					0.290968	2.675
Year 1988					0.429657	2.038
Year 1989	0.053627	2.2558	-0.02616	-0.961	0.570338	1.816
Year 1990	0.063904	2.8118	0.014418	0.593	0.714135	1.712
Year 1991	0.053718	2.4017	0.072626	3.013	0.795362	1.533
Year 1992	0.107259	4.9123	0.095674	4.064	1.020267	1.643
Year 1993	0.138693	6.8687	0.099211	4.28	1.224429	1.693
Year 1994	0.171473	8.0511	0.182096	8.332	1.451155	1.757
Year 1995	0.214546	10.65	0.240692	10.84	1.670817	1.8
Year 1996	0.257377	12.952	0.262695	9.95	1.86452	1.808
Year 1997	0.262637	11.985	0.282474	5.36	2.108422	1.859
Railroad Variables						
Line Impact Area	-0.05903	-4.584	-0.04789	-1.562	-0.0553	-3.353
Moderate Crossing Impact Area	-0.06815	-3.228	-0.0777	-2.831	0.062119	2.23
Moderate CIA * Ignore	-0.06691	-1.997	0.03008	0.737	-0.03953	-1.039
Moderate CIA * Ignore * Daysince	6.48E-05	2.9195	-1.20E-05	-0.291	-2.26E-05	-1.129
Severe Crossing Impact Area	-0.0517	-1.511	-0.19342	-3.185	0.068268	1.547
Severe CIA * Ignore	-0.05215	-1.004	0.048577	1.179	-0.03567	-0.536
Severe CIA * Ignore * Daysince	7.92E-05	2.5302	-3.75E-06	-0.076	-1.29E-05	-0.273
Line Impact Area	-0.13315	-6.15	-0.05781	-1.957	-0.07696	-2.187
Moderate Crossing Impact Area	-0.07781	-4.022	-0.12991	-3.068	0.008679	0.347
Severe Crossing Impact 0.006432	0	1885	0.04774	0.502	0.14362	-1.793
Adjusted R-squared	0.668579		0.609188		0.491219	
S.E. of regression	0.310421		0.341168		0.383304	
Mean, (σ) dependent var	10.97128	(0.539)	10.81136	(0.546)	11.80856	(0.537)
F-statistic	231.5029		107.6709		140.917	
Number observations	6971		5069		8986	
Log likelihood	-1705.42		-1702.34		-4102.06	

Table 4: Hedonic Regression Examining Effect of Conrail Action on Housing Price-Distance Gradients
Dependent Variable: Log of Real Price

	Butler County		Trumbull County		Middlesex County	
Variable	*Coefficient*	*Coefficient*	*Coefficient*	*t-stat*		*t-stat*
Intercept	-0.25892	-0.175	8.421265	5.248	418.0675	2.044
	Structural Characteristics					
Age house	-0.00329	-3.75	0.000119	0.104	-0.21	-2.035
Age house squared	-5.10E-06	-0.698	-4.74E-05	-4.014	2.11E-05	6.11
Bathrooms (OH) Full bath (MA)	0.028436	2.6147	0.107547	7.479	0.082255	7.883
Half bath (MA)					0.081156	8.827
Bedrooms	0.032442	3.5968	0.042806	4.138	0.009608	1.264
Other rooms	0.016575	3.1178	0.032659	3.772	0.008347	1.463
Fire place	0.130973	13.856	0.118197	9.289	0.062238	8.004
Garage area	0.000175	8.1336	0.000386	6.92		
Garage area squared	-5.07E-08	-4.691	-1.52E-07	-2.17		
Building area	0.000353	11.115	0.000454	7.596	0.000273	8.521
Building area squared	-2.71E-08	-4.191	-5.37E-08	-3.48	-2.46E-08	-4.142
Number of stories	-0.01971	-1.887	-0.06732	-4.609	0.05648	5.908
Lot area	5.47E-07	3.7971	2.18E-08	0.472	6.43E-07	2.946
Pool	0.087527	5.1222	0.07407	4.695		
	Neighborhood Characteristics					
Airport 3 miles	0.183971	5.4458	-0.30018	-2.492	-0.10669	-0.964
Airport 3 miles * distance	-0.05758	-4.948	0.104253	2.924	0.026107	0.561
Highway quarter mile	-0.16166	-0.562	-0.14314	-1.576	-0.06981	-2.072
Highway quarter mile * distance	0.910298	0.6726	0.553272	1.105	0.400412	2.071
% Owner occupied	0.002965	6.0806	-0.00255	-3.78	0.003587	1.825
% Occupied	-0.00198	-1.069	-0.01132	-3.815	-0.00322	-6.916
% Asian	0.00474	0.5382	-0.01508	-2.089	-0.46237	-3.156
% Black	-0.00507	-12.33	-0.00732	-7.347	-0.1026	-0.435
% Hispanic	-0.00611	-0.633	-0.04361	-3.576	0.187253	1.362
Median HH income	5.87E-06	6.1369	1.24E-05	8.5	4.11E-06	9.224
Commute time	-0.01229	-6.142	0.003081	1.091	-0.00068	-0.415
Population density	3.24E-06	1.0343	7.91E-06	1.989	-1.44E-06	-0.594
Super-fund within 3 miles	0.582255	2.1104			-0.01415	-1.256
Lake/River	-0.00673	-0.59	0.043649	2.197	-0.01982	-2.387
Tax rate	0.044898	1.3524	-0.03861	-3.626	46.93446	1.605
Median year built	0.005314	7.1268	0.001186	1.447	-0.20551	-1.995
Air quality monitor distance	0.000648	0.0642	-0.01182	-1.444	0.013903	2.326
Toxic Release Inventory	-0.02382	-1.899	0.078608	5.346	0.061732	7.281
Power plant 3 miles	-0.51129	-0.41	0.051022	0.857		
Power plant 3 miles * distance	3.47E-05	0.3312	-0.00986	-0.46		
	City Dummy Variables					
City dummy 1	-0.00186	-0.079	-0.37213	-2.831	0.893645	1.767
City dummy 2	0.076473	1.3722	-0.15952	-1.369	0.082541	1.618
City dummy 3			-0.16535	-2.293	0.100173	1.82
City dummy 4			-0.04114	-0.863	0.052221	1.672
City dummy 5					0.188934	4.784
	School District Dummy Variables					
School district 1	-0.05365	-0.295	0.447533	3.229	-0.0124	-0.532