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HAZARDOUS WASTE SITES AND HOUSING APPRECIATION RATES

by

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Hazardous Waste Sites and Housing Appreciation Rates

Abstract: The dynamic effect of a hazardous waste site is analyzed by investigating the causal relationship between housing appreciation rates and house location in relation to a hazardous waste site using resale data from individual sales transactions in Dallas County, Texas. The results indicate that in the period in which the hazardous waste site was identified and cleanup occurred, residential property owners in close proximity to the hazardous waste site experienced lower housing appreciation rates. In the first post-cleanup period, they gained some of the lost ground with a higher appreciation rate. In a subsequent post-cleanup period, their appreciation fell in line with property owners whose properties are located farther away from the hazardous waste site. This suggests that a long-run equilibrium has been reached since appreciation rates were not significantly different across the Dallas housing market in the second post-cleanup period. Although the results indicate that adjustment takes time, an equilibrium is eventually reached for the houses in this repeat sales data set. An important implication of our analysis is that since the post-cleanup recovery was not immediate, property owners should be compensated for their loss of liquidity.

Key words: housing appreciation rates, hazardous waste sites.

The public's increasing awareness of environmental risks is reflected in the negative impact of environmental contamination on property values in the real estate market. Although the effects of environmental contamination on property values have been studied, the current body of literature on the effects of locally undesirable land uses does not address the adjustment of property values to the discovery and cleanup of environmental contamination. Kiel *et al.* [9] come the closest to analyzing this issue. They examine the effect of an incinerator siting on housing appreciation rates. However, their study is limited to siting and operation and does not consider any time period after the incinerator has been shut down or removed. In contrast, this paper examines the impact of environmental contamination and cleanup on residential property value appreciation rates by analyzing data from before identification of the hazardous waste site and before, during, and after cleanup has been completed. Consequently, it is possible to empirically investigate the longer-run market adjustment.

Stigma is a negative attribute of real estate acquired by the discovery of contamination and reflected in price Elliot-Jones [4]. Using a theoretical model with external economies and adjustment costs, McCluskey [16] shows that both temporary stigma and permanent stigma are possible equilibrium outcomes after discovery and cleanup of a hazardous waste site. If the price adjustment after the cleanup of a hazardous waste site is gradual, as opposed to immediate and permanent, then the cost to the residential property owner cannot be measured immediately after cleanup.

The duration of stigma has significant legal ramifications. When the courts award stigma damages based on unrealized losses in property values, they are implicitly assuming that stigma damage is permanent and does not change over time. If stigma is temporary and compensation is awarded based on unrealized losses, then plaintiffs may receive a windfall. On the other hand, if the Courts consider the stigma to be temporary, then the property owner may receive no compensation, even though he or she has experienced a real loss. The loss emerges from the fact that during the period of temporary stigma, the asset is illiquid. Illiquid assets, all other things equal, generally have higher returns to compensate investors for what is given up in terms of liquidity. Consequently, determining the effect of environmental contamination and cleanup on housing appreciation rates is necessary to accurately estimate the true cost of the contamination to residential property owners.

In this paper, appreciation rates are calculated for houses in the vicinity of the RSR hazardous waste site. The RSR lead smelter in West Dallas, which operated from 1934 to 1984, caused soil contamination from air emissions and slag material. The slag material was used as fill in yards and driveways in nearby residences. The data set used in our analysis covers the period 1979 to 1995 and includes over 6,000 repeat sale observations. A repeat sales hybrid approach is advanced to examine the relationship between housing appreciation rates and the location of the house in relation to the hazardous waste site using data from individual sales transactions in Dallas County, Texas. The dynamic effects of the smelter are then analyzed by estimating its effect on housing appreciation rates.

The results indicate that during the time period in which the smelter was identified as a hazardous waste site and cleanup occurred, appreciation rates were negatively affected by proximity to the smelter. In the initial period after cleanup, the appreciation rates were relatively higher for houses in close proximity to the smelter. In a subsequent post-cleanup period, the appreciation rates were not affected by proximity to the smelter. Thus, residential property owners in close proximity to the smelter site experienced a lower appreciation rate, then gained some of the lost ground with a higher appreciation rate. Finally, after cleanup, their appreciation rates fell in line with property owners whose properties are located farther away from the smelter site. This suggests that a long-run equilibrium has been reached since appreciation rates were not significantly different across the Dallas housing market in the second post-cleanup period. Although our findings indicate that adjustment takes time, an equilibrium is eventually reached for the houses in this repeat sales data set.

II. Previous Studies

Although there have been many previous studies which attempt to measure the effect of environmental contamination and cleanup on property values, they focus on a short-run phenomenon. Most importantly, existing studies have not analyzed post-cleanup property values. Typically, impacts of contamination on property values are examined

with a cross-sectional data set at a single point in time.¹ By not including post-cleanup property values, these studies cannot structure the event analysis correctly to analyze the effects of cleanup.

Many authors have used property value data to value environmental attributes and, more specifically, study the impact of hazardous waste sites. This tangentially related literature is interesting because it examines the same kind of data, but not in the same way. Studies have shown that negative attitudes toward facilities which pose nuisance, health or environmental risks are strong and geographically extensive (Council on Environmental Quality, 1980; Lindell *et al.*, [15]). Many authors have used property value data to value environmental attributes and, more specifically, study the impact of hazardous waste sites. Ketkar [8], Kiel [9], Kohlhasse [13], Michaels *et al.* [17], Nelson *et al.* [18], Reichert *et al.* [19], Smith *et al.* [21], Smolen *et al.* [22], and Thayer *et al.* [23] have consistently found that proximity to hazardous waste sites and other locally undesirable land uses (LULUs) has a negative impact on property values.²

The appreciation rate of house prices can be used to calculate the user cost of owner-occupied housing. It is also used to compare the rate of return on investment in residential properties to other types of assets. Kiel *et al.* [9] find that housing appreciation rates are affected as early construction begins on a locally undesirable land

¹ Exceptions include Kohlhasse [13] and Kiel [9] and Dale *et al.* [3]. Kohlhasse [13] and Kiel [9] examine property values at more than one point in time, but do not consider post-cleanup property values. Kiel *et al.* [12] examine housing prices before and after a failed incinerator siting. However, for the latter analysis the incinerator was only hypothetical.

² For additional cites, see Farber [5], which provides a comprehensive survey of empirical results.

use, and the adjustment continues several years after the facility has begun operation. Greenberg *et al.* [6] and Greenberg *et al.* [7] have analyzed the effect of hazardous waste sites on housing appreciation rates. However, these two studies are based on aggregate and survey data rather than individual sales transactions.

III. Model of Housing Appreciation Rates

The dynamic effects of the hazardous waste site can be examined by estimating its effect on housing appreciation rates. The annual appreciation rate, r , is defined as:

$$(1) \quad (1+r)^{(t-\tau)} = \frac{P_t}{P_\tau}$$

Where τ is the year of the first sale, and t is the year of the second sale. Solving for r , we obtain

$$(2) \quad r = \exp \left[\frac{\ln \left(\frac{P_t}{P_\tau} \right)}{t - \tau} \right] - 1.$$

The appreciation rate was calculated for each house in the resale data set. Following Kiel *et al.* [11], the annual appreciation rate for each house (multiplied by 100) is used as the

dependent variable in regressions with housing, neighborhood, and environmental attributes as the explanatory variable. The estimated model is then the following:

$$(3) \quad r = \beta_0 + \sum_{i=1}^n \beta_i x_i + \varepsilon .$$

Where the x_i 's are the explanatory attributes and ε is an error term.

The explanatory attributes include different variables which affect the sale price, including house, neighborhood and environmental quality attributes. Housing quality is described by the square footage of living space, number of bathrooms, lot size, and dummy variables indicating the presence of a pool, central air conditioning, house condition and similar variables. Neighborhood quality is based upon variables such as percent of the residents in the census tract that the house is located in that are below the poverty level, ethnic composition of the census tract that the house is located in, and accessibility to the Dallas-Ft. Worth airport and the Dallas central business district (CBD) and the Galleria Mall. Environmental quality is described by proximity to the RSR lead smelter and three other sites. (Other environmental indicators, e.g., air and water quality, do not vary by location and were not included in this study).

IV. Background and Data

The most important and publicized of the contaminated sites included in this study is the RSR lead smelter. The RSR lead smelter is located in the central portion of Dallas County, approximately six miles west of downtown Dallas. The smelter operated from 1934 to 1984 and was purchased in 1971 by the RSR Corporation. The smelter emitted airborne lead, which contaminated the soil in the surrounding areas. Lead debris created by the smelter was used in the yards and driveways of some West Dallas residences. In 1981, the EPA found health risks, and RSR agreed to remove any contaminated soil in the neighborhoods surrounding the RSR site using standards that were considered protective of human health at the time. In 1983 and 1984, additional controls were imposed by the City of Dallas and the State of Texas. In 1984, the smelter was sold to the Murmur Corporation who shut the smelter down permanently. In 1986, a court ruled that the cleanup was complete.

In 1991, the Center for Disease Control (CDC) lowered the blood level of concern for children from thirty to ten micrograms of lead per deciliter of blood. Low-level lead exposure in childhood may cause reductions in intellectual capacity and attention span, reading and learning disabilities, hyperactivity, impaired growth, or hearing loss (Kraft *et al.* [14]. Also in 1991, the State of Texas found hazardous waste violations at the smelter. In 1993, the RSR smelter was placed on the Superfund National Priorities List (NPL). For a summary, see the Event History in Figure 1 below.

Figure 1
Event History of RSR Site

Three other contaminated sites are included in this study. These additional sites were selected on the basis of relative importance and proximity to active housing markets in the region. Each of these sites was listed on the EPA's Comprehensive Environmental Response, Compensation, and Liability Inventory List (CERCLIS) during the study period, and none was cleaned up or removed from CERCLIS during the study period. Information about these sites is presented in Table 1.

The analysis covers the impact of the smelter on property values over four event-driven time periods: (1) pre-1981, when the smelter operated but health risks were not officially identified nor publicized; (2) 1981-86, when health risks from soil contamination were officially identified, cleanup was initiated and a Court ruled cleanup was completed; (3) 1987-90, after cleanup was ruled completed; and (4) 1991-95, when new concerns arose and additional cleanup occurred. The equation for the initial time period (1979-80) serves as a baseline for comparison to subsequent analysis.

Slovic *et al.* [20] provides support for the use of event-driven time periods. In particular, they argue that social amplification of risk is triggered by the occurrence of an adverse event.³ Kiel *et al.* [11] also divide their data into event-driven time periods in order to analyze the effect of changes in information over time about an incinerator siting on property values. Wald Tests for structural change, which do not assume that the disturbance variance is the same across regressions, were performed to test if the event-driven periods are the same. The results indicate that each significantly period is different.

The repeat sales data set includes variables describing price⁴ and attributes of single-family, detached homes sold over the period 1979 to 1995 in Dallas County, Texas (Dallas County Appraisal District). The price appreciation rate was calculated for each house, which was sold twice within any one of the four event-driven periods, but not

³ Slovic *et al.*, [16], p. 685.

⁴ Prices are deflated using the shelter housing price index (1982-84-100) from the *Economic Report of the President*.

within the same year. There are 6,321 houses that fit this criterion. The repeat sales-data set allows for a non-confounded analysis because the structural characteristics of the house do not usually change over time. A drawback of repeat sales analysis is that the sample size is usually much smaller than if single sales observations were included.⁵

Using a Geographic Information Systems (GIS) database, Dallas County was set up as a grid of X and Y coordinates. Coordinates were assigned to each house and the airport, CBD, the Galleria Mall and the hazardous waste sites. Distance could then be calculated between any two points. The GIS database was also used to link each house to its census tract (and the corresponding demographic information). A description of the variables used in the analysis and descriptive statistics are presented in Table 2. Finally, we note that Abraham *et al.* [1] found that there was a general real price decline in the Dallas metropolitan housing market in the time period covered in this study. They refer to the period 1987-1992 as a “bust” period.

V. Estimation Results

Using the repeat sales data set, appreciation rates were calculated for each of the event-driven time periods. Crone *et al.* [2] compared five methods of estimating housing appreciation rates and found the repeat sales method to be the most accurate. The hypothesis considered is that the smelter has no effect on housing appreciation rates.

⁵ Using repeat sales as the selection criterion may create selection bias because the most stigmatized houses may not have been sold after cleanup. In general, restricting the data to houses that are sold more than

This hypothesis can be rejected if the coefficient on distance from the smelter is significantly different from zero. The results are presented in Table 3. In the period before identification of the smelter (1979-1980), the coefficient on distance from the smelter is negative, but insignificant. In the period in which identification and cleanup occurred, which was also a period of intense media coverage (1981-1986), a location that is farther away from the smelter had a positive and significant effect on the appreciation rate of the house. In the first post-cleanup period (1987-1990), the houses with locations that are in close proximity to the smelter experienced a significantly higher appreciation rate than houses located farther away. Finally, in the period of additional concern about the smelter area (1991-1995), a location that is farther away from the smelter had a positive but insignificant effect on the appreciation rate of the house.

Another hypothesis is that the smelter has the same effect on housing appreciation rates in each of the event-driven time periods. This hypothesis can be rejected if the coefficient on distance from the smelter is not equal across all time periods. This hypothesis is rejected since the coefficient on distance from the smelter is significantly different from the comparable coefficients in previous and subsequent periods.

Although the focus of this paper is on the effect of a hazardous waste site on housing appreciation rates, there are some additional observations that can be made based on the estimation results. However, in general, it is difficult to draw conclusions across time periods with respect to the effects of amenities. Keeping that in mind, the boom and

once may mean that the sample is not representative of the housing market.

bust cycles are evident from the positive and significant intercept terms in the time periods that cover 1981-1986 and 1991-1995 and the negative, although insignificant, intercept term for the period 1987-1990. The time period 1981-1986 was a strong period for housing sales. During periods where appreciation rates high, amenities often do not obtain the premiums that they otherwise would. This may be explained by the fact that people are generally less picky when housing prices are rapidly accelerating. An extreme example of this is the recent situation in the South Bay Area of California, known as Silicon Valley. Houses with few amenities have been receiving multiple bids well above the asking price as soon they go on the market.

The time period 1991-1995 contains the end of a bust period and a recovery period. It is interesting that during this time period specific amenities such as central air conditioning negatively influence appreciation while designations of "good" and "average" condition positively influence appreciation rates. This means that homes in relatively good condition are appreciating faster than homes in poor condition that have amenities such as central air conditioning. Also during this time period, the percentage of poverty in the census tract in which the house is located negatively influences appreciation rates, while the percentage of black and Hispanic residents increases appreciation rates. From this, one could conclude that certain black and Hispanic neighborhoods are becoming more desirable locations, as reflected in the real estate market.

VI. Conclusion

Our results demonstrate that individual housing appreciation rates are affected by proximity to a hazardous waste site. Specifically, during the time period in which the RSR smelter was identified as a hazardous waste site and cleanup occurred, appreciation rates were positively affected by distance from the smelter. In the initial period after cleanup, the appreciation rates were negatively affected by distance from the smelter. In a subsequent post-cleanup period, the appreciation rate was not affected by distance from the smelter. Thus, residential property owners in close proximity to the smelter site experienced a lower appreciation rate. However, after cleanup was ruled completed they experienced a higher appreciation rate relative to other Dallas Area property owners. Finally, in the subsequent period after cleanup, their appreciation fell in line with property owners whose properties are located farther away from the smelter site. This suggests that a long-run equilibrium was reached since appreciation rates were not significantly different across the Dallas housing market in the second post-cleanup period. Although our findings indicate that adjustment takes time, the equilibrium was eventually reached for the houses in this repeat sales data set.

From this analysis, we conclude that for the houses in close proximity to the RSR smelter there was a temporary stigma, which was corrected in the periods after cleanup. However, there may be some selection bias in the nature of a repeat sales approach. Houses which are closest to a hazardous waste site that were held off the market or had

no offers after the publicity about the smelter are the most likely candidates for longer-term or permanent stigma.

An important implication of our analysis is that since the post-cleanup recovery was not immediate, property owners should be compensated for their loss of liquidity. Just as illiquid investment assets generally offer a higher rate of return to offset for the level of liquidity, property owners whose property is temporarily stigmatized should be compensated for losing the option to sell at the price of a pristine property during the period of adjustment.

References

1. J.M. Abraham and P.H. Hendershott, Bubbles in metropolitan housing markets, *Journal of Housing Research* 7, 191-207 (1996).
2. T.M. Crone, and R.P. Voith, Estimating house price appreciation: A Comparison of Methods, *Journal of Housing Economics* 2, 324-38 (1992).
3. L. Dale, J.C. Murdoch, and M.A. Thayer, Do property values rebound from environmental stigmas? Evidence from Dallas County, Texas, *Land Economics* 75, 311-326 (1999).
4. M. Elliot-Jones, Stigma in light of recent cases, *Natural Resources & Environment* 56-59 (Spring 1996).
5. S. Farber, undesirable facilities and property values: a summary of empirical studies, *Ecological Economics* 24, 1-14 (1998).
6. M.R. Greenberg and R.F. Anderson, Hazardous waste sites: the credibility gap, The Center for Urban Policy Research, Rutgers, The State University of New Jersey (1984).
7. M.R. Greenberg and J. Hughes, Impact of hazardous waste sites on property value and land use: Tax assessors' appraisal, *The Appraisal Journal*, 61, 42-51 (1993).
8. K. Ketkar, Hazardous waste sites and property values in the state of New Jersey, *Applied Economics* 24, 647-59 (1992).
9. K.A. Kiel, Measuring the impact of the discovery and cleaning of identified hazardous waste sites on house values, *Land Economics* 71, 428-35 (1995).

10. K. Kiel and K. McClain, House prices during siting decision states: the case of an incinerator from rumor through operation, *Journal of Environmental Economics and Management* **28**, 241-255 (1995a).
11. K. Kiel and K. McClain, The effect of an incinerator siting on housing appreciation rates, *Journal of Urban Economics* **37**, 311-323 (1995b).
12. K.A. Kiel and K.T. McClain, House price recovery and stigma after a failed siting, *Applied Economics* **28**, 1351-58 (1996).
13. J.E. Kohlhase, The impact of hazardous waste sites on housing values, *Journal of Urban Economics* **30**, 1-26 (1991).
14. M.E. Kraft and D. Scheberle, Environmental justice and the allocation of risk: the case of lead and public health, *Policy Studies Journal* **23**, 113-123 (spring 1995).
15. M. Lindell and T.C. Earle, How close is close enough: public perceptions and the risks of industrial facilities," *Risk Analysis* **3**(4): 245-253 (1983).
16. J.J. McCluskey, *Environmental Contamination and Compensation*, Ph.D. Dissertation, University of California, Berkeley, 1998.
17. R.G. Michaels and V.K. Smith, Market segmentation and valuing amenities with hedonic models: The case of hazardous waste sites, *Journal of Urban Economics* **28**, 223-242 (1990).
18. A.C. Nelson, J. Genereux, and M. Genereux, Price effects of landfills on house values, *Land Economics* **68**, 359-365 (1992).
19. A.K. Reichert, M. Small, and S. Mohanty, The impact of landfills on residential property values, *The Journal of Real Estate Research* **7**, 297-314 (1992).

20. P. Slovic, *et al.* Perceived risk, stigma, and potential economic impacts of a high-level nuclear waste repository in Nevada, *Risk Analysis* **11**, 683-696 (1991).
21. V.K. Smith and W.H. Desvousgous, The value of avoiding a LULU: hazardous waste disposal sites, *The Review of Economics and Statistics* 293-299 (1986).
22. G.E. Smolen, G. Moore, and L.V. Conway, The economic effects of hazardous chemical and proposed radioactive waste landfills on surrounding real estate values, *The Journal of Real Estate Research* **7**, 283-295 (1992).
23. M. Thayer, H. Albers, and M. Rahmatian, The benefits of reducing exposure to waste disposal sites: a hedonic housing value approach, *The Journal of Real Estate Research* **7**, 265-282 (1992).

Table 1. Contaminated Sites Included in the hedonic price analysis

Site	Type of Contamination	Year Listed on CERCLIS	Status
Site1: RSR Smelter	Soil	1981	Court ordered cleanup in 1983
Site2: Superior Site	Ground water	1981	Not contained
Site3: Dallas Naval Weapons Site	Ground water, soil, surface water	1984	Not contained
Site4: Crews Plating Site	Soil	1994	Not contained

Table 2. Resale Data: Variable Descriptions and Sample Statistics

Name	Description	Means & Standard Deviations			
		'79-'80	'81-'86	'87-'90	'91-'95
N	Number of Observations	147	2691	1095	2385
Ldprice	Log of deflated sales price	11.14 (0.49)	11.40 (0.59)	11.33 (0.62)	11.03 (0.70)
Livarea	Square feet of living area	1667.88 (656.06)	1806.31 (735.96)	1910.52 (773.96)	1842.24 (771.32)
Baths	Number of bathrooms	1.91 (0.66)	2.04 (0.72)	2.14 (0.74)	2.09 (0.74)
Landarea	Lot size in square feet	9152.18 (3368.4)	9474.94 (3949.7)	9313.51 (4004.7)	9209.75 (3917.7)
Pool	1 if pool, 0 otherwise	0.11 (0.32)	0.15 (0.36)	0.17 (0.38)	0.15 (0.36)
Garage	1 if attached garage, 0 otherwise	0.85 (0.35)	0.88 (0.32)	0.91 (0.29)	0.89 (0.31)
Central Air	1 if central air conditioning, 0 otherwise	0.86 (0.35)	0.89 (0.32)	0.92 (0.27)	0.90 (0.30)
Heat	1 if central heat, 0 otherwise	0.87 (0.33)	0.90 (0.30)	0.93 (0.26)	0.91 (0.28)
Good	1 if good condition, 0 otherwise	0.15 (0.36)	0.27 (0.44)	0.38 (0.48)	0.37 (0.48)
Average	1 if average condition, 0 otherwise	0.83 (0.37)	0.72 (0.45)	0.61 (0.48)	0.61 (0.49)
Galleria	Miles to the Galleria shopping center	11.38 (5.68)	10.18 (5.59)	10.15 (5.76)	10.66 (5.82)
CBD	Miles to the central business district	10.51 (3.58)	10.84 (3.75)	11.38 (3.99)	11.21 (3.98)
DFAIR	Miles to Dallas/Fort Worth Airport	18.83 (5.68)	17.53 (5.98)	17.44 (6.11)	17.97 (6.19)
Poverty	% of the census track below the poverty line	6.09 (5.08)	6.48 (5.68)	6.87 (6.42)	8.31 (8.01)
Black	% of the census track that are African American	7.19 (15.31)	7.68 (13.28)	9.42 (13.21)	12.55 (16.03)
Hispanic	% of the census track that are Hispanic	8.22 (8.56)	9.47 (10.21)	10.41 (11.61)	13.14 (14.71)
Site2	Miles to Site2	12.82 (4.89)	13.97 (5.11)	14.62 (5.33)	14.19 (5.40)
Site3	Miles to Site3	15.94 (6.35)	15.92 (6.07)	16.39 (5.87)	16.20 (6.07)
Site4	Miles to Site 4	12.55 (5.08)	10.91 (4.94)	10.99 (5.05)	11.35 (5.13)
Distance	Miles to the RSR facility	12.67	10.96	12.45	12.43

Table 3 Housing Appreciation Rate Estimation

Variable	1979-1980	1981-1986	1987-1990	1991-1995
Intercept	-2.550 (-0.02)	21.434** (3.19)	-7.341 (-0.60)	21.326* (1.85)
Livarea	0.021 (0.80)	0.002** (2.06)	-0.003* (-1.76)	-0.001 (-0.94)
Baths	-12.816 (-0.63)	-0.104 (-0.12)	-0.146 (-0.10)	0.499 (0.31)
Pool	35.441 (0.88)	0.347 (0.33)	-1.228 (-0.75)	-3.876 (-1.82)
Landarea	-0.001 (-0.65)	3.36E-5 (0.36)	3.345E-4 (2.11)	6.74E-5 (0.39)
Garage	-3.834 (-0.21)	-3.372** (-3.30)	1.394 (0.58)	-9.249** (-3.73)
Central Air	3.982 (0.13)	-2.77 (-1.62)	-1.688 (-0.36)	-16.597** (-3.97)
Heat	5.617 (0.16)	-1.889 (-1.06)	-1.253 (-0.25)	1.973 (0.45)
Good	-20.69 (-0.20)	-22.35** (-5.70)	11.364 (1.53)	20.748** (33.21)
Average	-13.769 (-0.15)	-22.45** (-5.85)	8.690 (1.17)	18.925** (2.97)
Galleria	-5.182 (-0.55)	1.894** (5.11)	-0.374 (-0.51)	-0.284 (-0.34)
CBD	0.025 (0.00)	-5.892** (-7.64)	0.644 (0.38)	-3.534** (-2.04)
DFWAIR	6.368 (0.53)	0.390 (1.24)	-0.015 (-0.03)	-0.543 (-0.91)
Poverty	2.044 (0.81)	0.030 (0.28)	-0.031 (-0.17)	-0.441** (-2.76)
Black	-0.610 (-0.92)	0.017 (0.47)	-0.206** (-2.70)	0.026** (4.21)
Hispanic	-1.111 (-0.75)	-0.059 (-1.08)	-0.076 (-0.70)	0.249** (2.69)
Site2	2.566 (0.45)	1.959** (6.00)	0.915 (1.58)	0.818 (1.41)
Site3	-2.970 (-0.26)	-0.283 (-0.80)	1.463* (1.89)	0.480 (0.66)
Site4	1.593 (0.12)	-2.006** (-4.42)	1.310 (1.07)	0.762 (0.57)
Distance	-3.010 (-0.14)	3.829** (4.42)	-4.402** (-2.06)	0.944 (0.46)

Note: Values in parentheses are t-statistics.

*Significant at $\alpha = 0.10$.

****Significant at $\alpha = 0.05$.**