An Investigation into the Impact of Hazardous Waste Contamination Liability in Urban Industrial Land Redevelopment in the City of Chicago

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A Great Cities Institute Working Paper

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The Great Cities Institute

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Daniel T. McGrath, Ph.D., **is** the Coastal Economic Development Specialist with the Illinois-Indiana Sea Grant Program, a joint project of the University of Illinois and Purdue University. He holds bachelor degrees in mechanical engineering and history and an MBA in finance from the University of Notre Dame, a Master's degree in economics and Ph.D. in public policy analysis from UIC. Dr. McGrath's ongoing research includes empirical investigations of the impacts of land contamination on industrial land value and the likelihood of private development. In his Sea Grant role, Dr McGrath's current work is on the development of comprehensive, science-based decision support models that can provide accurate forecasts of the impact of metropolitan urbanization to the coastal, surface and groundwater resources of the region. Dr. McGrath was previously a Research Economist with UIC's Energy Resources Center. In this capacity, he investigated economic impacts of various energy technology innovations and coordinated empirical research into the factors that signal firm adoption of pollution prevention activities.

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Introduction

The purpose of this research is to investigate empirically how the behavior of buyers and developers of industrial property in Chicago might be influenced by the perceived contamination risk. There seem little question in most policymakers' minds that this problem exists, and that its impact is quite substantial. This study is focused on taking a historical look at the problem and presents a method to measure its impact on both industrial land value and industrial redevelopment within the City of Chicago. There exist no previous studies that have attempted to systematically measure this problem, and this study hopes to begin to fill that gap.

This study draws heavily on previous theoretical and empirical work. The first theoretical base for this study is a paper by James Boyd and others at Resources for the Future. These authors developed the first microeconomic model to explain the behavior of buyers and sellers of industrial land in the context where both face uncertain contamination liability on parcels, and point out that the common notion that contamination puts urban land at a cost disadvantage over greenfield land is perhaps too simplistic an economic story. Simply pointing to uncertainty and risk-aversion is also not a sufficient explanation, as market price adjustments could easily handle these common issues. Rather, Boyd et. al. contend that it is information asymmetries between buyers and sellers that affect the valuation process-- that is, buyers do not know as much as sellers know about the condition of a parcel and CERCLA-induced uncertainties may cause buyers to overestimate the "contamination liability lottery" that they face in purchasing a parcel of urban industrial land with uncertain contamination.

The second theoretical work on which this study is based is by Jan Brueckner (1980) at the University of Illinois at Urbana-Champaign. This approach--value differential theory-develops a model which identifies when redevelopment will take place. The idea is straightforward. Urban land will be redeveloped when it is profitable to do so, or, more precisely, when there is real economic profit to be captured by converting it to a new use. There have been two recent subsequent empirical studies which use the framework developed by Brueckner. Most notable of these is a study of industrial and commercial land in Chicago by Munneke (1994) which finds support for Brueckner's value differential theory. This study follows closely Munneke's econometric methodology.

By combining the two above theoretical approaches, a unique method for evaluating the impact of contamination risk on redevelopment emerges. For a given industrial parcel, as the likelihood of contamination increases, the more likely it is that a buyer might overestimate the liability lottery of the parcel. The lowered effective valuation of the buyer reduces the expected gain to be made by redevelopment of the parcel to a new use and, thus, lowers the likelihood of redevelopment.

For this study, historical data of redeveloped industrial properties from the City's various databases have been collected. The historical land use of these properties is investigated, and a measure of the likelihood and severity of the contamination liability associated with the properties is devised. By comparing the group of redeveloped properties with a control group of industrial properties that were not redeveloped, a measure of the impact of contamination risk on land value and on the probability of redevelopment can be determined.

The Redeveloped Property Dataset

The principal dataset for this research is a group of 95 redeveloped industrial properties within the City of Chicago that were sold from August, 1983 through December, 1993. This dataset was created by matching 8,043 industrial sale records from the City's Harris/REDI database with 1,867 industrial building permit and 881 industrial demolition permit records obtained from the City's Department of Buildings. The decision rule used for inclusion into the redeveloped property group is as follows: If a property was sold and had an industrial demolition and/or an industrial building permit filed for the property within 24 months of the sale and is currently zoned for manufacturing use, then the property is considered to have been purchased with the intention of redevelopment for industrial use. Clearly, a deeper level of investigation would be required to determine with certainty if redevelopment did indeed take place. The focus here is that a transaction took place and farther investment into the property was likely.

It is important to emphasize that this group of 95 redeveloped properties is only a sample and does not represent the universe of industrial redeveloped properties in the City. Excluded would be situations where owners redeveloped their own property. Also, the limitations of our matching program excluded a number of valid properties, most notably comer parcels where the sale and the permit were listed on different streets. This study contends that the sample is large enough to identify any systematic determinants of value. Also, this dataset is the first available dataset to link sales information of industrial properties to census tract information.

In total, the group of 95 industrial properties cover just over 8 million square feet of land area and range in size from as small as 2,700 sq.ft. to 1.4 million sq.ft., with an average and median size being 82,000 s.f. and 36,000 s.f. respectively. The sale amounts of these properties total approximately $63 million, with sales ranging from $15,116 to $11 million in real 1995 dollars. The average and median sales are $846,000 and $270,000 respectively. The properties are fairly well distributed throughout the city (see figure 1), and there are noticeable clusters of observations on the near northwest side (Clybourn corridor) and in the old stockyards area.

The other group of sales--the control group of approximately equal size (99 observations)--was chosen randomly from the pool of 8000+ sales. These properties have been verified to have had no building or demolition permits associated with them at any time after the sale and are also currently zoned for manufacturing. In this report, the control group is also referred to as the "current-use" group. This term comes from the notion that, if there was no evidence of redevelopment following the sale, then the sale must have been for a use not radically different from the parcels use immediately prior to sale--hence the term "current-use". In a competitive land market, the seller's valuation of a parcel should be equivalent to the parcel's current-use value. Figure 2 maps the control group, or current-use, properties.

The Environmental Variable

A key component of this analysis is identifying for every property in the dataset some measure of the property's likely severity of contamination. For a buyer or developer to go ahead with a purchase and subsequent redevelopment, one would expect that the buyer/developer would have done all that due diligence required to identify whether contamination would be a likely problem. By not doing so, the buyer/developer would be open to the liability net of CERCLA. Section 122 of CERCLA states that as long as a purchaser does not know and has no reason to know about any hazardous substances on the property, then the "innocent landowner" defense is available.1 However, according to USEPA guidelines, a buyer cannot claim this defense unless it was clearly demonstrated that "all appropriate inquiry into previous ownership and uses of the property" has been conducted. Obviously, this is the reason that phase I and phase II analyses are now customary practice before any industrial land transaction takes place.

In practice, a buyer would be making an educated assessment of the "contamination liability lottery" that he might face by completing the transaction. Emphasis is on the word "lottery". The actual liability or clean-up costs are unknown and will only become known once the transaction and any subsequent clean-up is completed. Thus, the liability is stochastic--there is a likely range and mean value to the clean-up costs. It is the buyer's responsibility to make as accurate an assessment of this lottery as possible.

Also, not all properties carry the same liability lottery. The range of clean-up costs can vary widely, depending on the severity of contamination, and the severity of contamination depends on the historical industrial use of the property. This fact has been demonstrated by Noonan (1992) in an analysis of contamination remediation histories of 17 environmental engineering firms in the Northeast United States. Table I presents the various industrial uses and their associated contamination probabilities.

This study proposes that there exists a vector of observable characteristics, E, of which the unknown contamination liability lottery is a function. E is a series of characteristics that are a significant determinant of the actual lottery that a buyer faces by completing the transaction and acquiring the property with uncertain contamination.

To represent the vector, E, three variables are proposed:

- Continuous Variable 1: The a-priori probability of parcel contamination for the individual industrial land use as identified by Noonan in a survey of completed clean-ups by 17 environmental engineering firms in the Northeast U.S.

- Dummy Variable 2: If the property SIC-code assignment is among the group of industries generating the total toxic waste releases to the environment in Cook County in both 1989 and 1994, as identified by the Illinois Environmental Protection Agency Bureau of Chemical Safety.

1 This defense was extended to lenders under the 1986 SARA amendments to Superfund.

- Dummy Variable 3: If the property SIC-code assignment is among the group of industries represented in the list of 138 ongoing and completed hazardous waste cleanups within the City of Chicago as identified by the Illinois Environmental Protection Agency Bureau of Land.

The primary reason this method is used is that an actuarially-accurate estimate of the actual liability lottery the buyer faces is not available. Most clean-ups of industrial land are done privately, and the costs incurred are private information. At present, there are no publicly available cleanup cost databases which might be used to produce either a clean-up cost estimate or to produce statistically significant risk factors.2

A historical land use investigation for each of the properties in both the redeveloped group and the control group has been undertaken, in an effort to duplicate the process a buyer would have undertaken in a phase I investigation. To determine historical land use, each property has been researched in both the 1949 and 1975 revisions of the Sanborn Fire Insurance Maps. These maps, available on microfilm, provide a wealth of land use information, often identifying the specific company using the site and/or the nature of the industrial activity taking place on the site. From this investigation, each property has been assigned an SIC-code interpretation which best represents its historical land use and then assigned a value of the apriori probability of contamination based on the identified industrial activity.

The Model and the Hypotheses of the Study

If environmental liability is part of the buyer's and seller's valuation process, then a measure of that liability should determine land value. Hypothesis 1 of this study is that the likely severity of a parcel's contamination is a significant determinant of parcel value for both the redeveloped value function, V^R, and the current-use value function, V^C. A difference in the coefficient value of the variable, E, or a difference in the significance of the variable between the redeveloped and current-use land value functions would point to the existence of information asymmetries between buyer and seller. If an increase in E reduces redeveloped value more than it reduces current-use value, then E has a greater effect on the buyer's effective valuation than the seller's effective valuation.3 Another possibility is that the environmental variable, E, is simply not relevant to current-use value. Rather, only redevelopment exposes the owner to contamination discovery and liability.

If contamination severity influences lenders, and they arbitrarily halt or limit lending to buyers of industrial properties with uncertain contamination liability, then the likely severity of contamination should be a significant determinant of the probability of an industrial parcel's redevelopment.

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2 Although there are private cleanup cost databases available at a substantial price.

3 Theoretically, if a parcel is sold for current use, V^C should identify both the buyer's and the seller's valuation of the parcel in a competitive land market. Therefore, under perfect competition, $V^C = V_S = P_{Land} = V_B$. However, V^R identifies only a buyer's valuation and most likely reflects the real economic profit to be captured by the buyer through the conversion of the parcel to a new use. Thus $V^R = V_B > P_{Land} > V_S$. The actual distribution of the economic profit remains unclear, however. This paper will assume that the buyer and the seller will divide equally any real economic profit obtained from a sale for redevelopment. Thus VR = (VB - Vs)/2.

Thus, hypothesis 2 of this study is that the probability that an urban industrial parcel is sold and redeveloped is a function of the existence of the effective value differential, *(VI - VI),* and also the potential severity of the parcel's contamination, variable E. The functional form of these two hypotheses can be written as follows:

$$\Psi^{R} = F\,[\,(\,V^{Eff}{}_{B}\,(E) - V^{Eff}{}_{S}\,(E)\,),\,E\,]$$

where: Ψ^{R} = the probability of redevelopment.

E = Environmental variable: the potential severity of contamination.

$V^{Eff}{}_{B}\,(E) \equiv V^{R}$ = the buyer's effective valuation as a function of E.

$V^{Eff}{}_{S}\,(E) \equiv V^{C}$ = the seller's effective valuation as a function of E.

In summary, if E is a significant determinant of land value, then a measure of the gain in land value generated by a site clean-up can be estimated. This valuation will be an important component of a cost-benefit analysis of a publicly-funded clean-up, as any increase in land value might also generate a fiscal benefit for the City. Also, If E is significant at determining the probability of redevelopment, then this is evidence that there is an investor bias against properties with high probability of contamination--a "brown-lining" against industrial property within the city. In theory, this measure could help the City identify where a publicly-funded cleanup might bring a marginal piece of industrial property back into a competitive position in the private land market. In such a case, any new employment generated by any redevelopment could be credited to the clean-up of the property.

Specification of the Regression Model

The dependent variable of the land value models, the functional form of which is presented in Appendix A, is the natural log of the parcel's price per square foot (unit price), LNUP. The prices of all the sale amounts have been converted to real price with a base time period of June 1995, and the 95$ sale prices were calculated by use of the Chicago Metropolitan Price Index published in the Monthly Labor Review. The overall mean of LNUP for the redeveloped group is 2.5150 with a standard deviation of 1.2315. The overall mean of the per square foot unit price for the redeveloped group is $23.35 with a standard deviation of $30.65. The mean LNUP for the control group is 2.6347 with a standard deviation of 1.0695. The mean unit price and standard deviation of the per square foot unit price for the control group is remarkable similar to the redeveloped group. The mean unit price is $23.85 with a standard deviation of $31.01. The general statistics of the dependent and independent variable and other statistics of importance for the redeveloped and current-use parcels are presented in Tables 2.A and 2.B respectively.

The two dominant explanatory variables for the land value model are measures of the land area and the fixed capital on the site. The value of any given parcel would be directly related to the "quantity" of industrial real estate available on the parcel, and fundamentally, the quantity of industrial real estate is made up of the land area of the parcel and also the usable space provided by the structure on the site. Appendix A outlines the derivation of the functional form. The specific measures of land and capital are the natural log of the land area, LNA, and the natural log of the ratio of building space to land area, which is also referred to as the capital intensity of the site, LNCAPINT.

Locational Variables: The other explanatory variables of the model contain locational, site, neighborhood, and regional economic variables, and these variables capture the various effects of the different sub-markets within the City. The locational variables are represented by five variables: CBD, INRING, OUTRING, LNORTHD, and INTCHGD. The geographic measurements were made by use of a GIS mapping software of the City of Chicago. Taken together, the locational variables should delineate the geographical industrial submarkets within the City. The pattern created by the above variable divides the City into six basic sectors with a possible positive effect due to the interaction of the expressways crossing the City.

- CBD is the distance in miles from Chicago's downtown Central Business District. Ground zero was arbitrarily chosen to be the intersection of LaSalle and Jackson Streets in the center of Chicago's financial district. A number of researchers mentioned in the literature review have found that distance from the CBD is not a significant determinant of value for industrial land. This may be true when analyzed on a regional, metropolitan level. However, within the city, the conventional wisdom is that the central business district is a powerful anchor for industrial land market. If the various industrial real estate submarkets within the City can be successfully identified, then the expectation is that increased distance from the CBD will lower a parcel's unit price. The mean value of CBD for the redeveloped group is 5.77 miles with a standard deviation of 2.90 miles. For the control group, the mean value is 5.48 miles with a standard deviation of 2.71 miles.

- INRING is a dummy variable which equals 1 if the variable CBD is less than 5.5 miles. This represents an inner-ring location of a parcel. Most of the City's most economically. depressed neighborhoods are within a five and a half mile ring of the city. The expectation is that an inner-ring location will have a negative effect on a parcel's unit price. 46% of the redeveloped group have an inner-ring location, and 52% of the control group have an inner-ring location.

- OUTRING is also a dummy variable which equals I if the variable CBD is greater than 9.5 miles. It represents a parcel location within an outer-ring of the business district. Given the long narrow shape of the City of Chicago, this variable generally identifies parcels that are located on the far North and far South regions of the City. These areas continue to be relatively attractive industrial locations. The far north area has close access to O'Hare airport. The far south region along the Indiana border has close access to the major east-west interstate routes. The expectation is that parcels in this region will command higher per unit prices. In the redeveloped group, 16% have an outer-ring location, while 11% of the control group have an outer-ring location.

- LNORTHD is a dummy variable which equals I if the parcel location is north of Lake Street. Lake Street is an major east-west route that runs the entire width of the City, and is generally considered to be the north-south dividing line. There is little debate that there are radical differences between the north and south regions of Chicago. Industrial real estate professionals generally divide the industrial land market into a north/south designation. In general, the southern regions of the city are more economically depressed than the north regions of the city. Most of the economic growth within the City of Chicago over the last decade has occurred in the North region of the City east of the Kennedy Expressway. The expectation is that a northern location will have higher value relative to a southern location, given the competition in land markets in the northern sector of the City over the last decade. In the redeveloped group, 63% of the parcels have a north location. Forty-eight percent of the control group have a north location.

- INTCHGD is a dummy variable which equals 1 if the distance to the nearest expressway interchange is greater than 2 miles. Fifty-three major interchanges were located within the Chicago city limits, and using GIS software, the shortest distance was identified to one of the 53 expressway interchanges for each observation. The expectation is that a parcel greater than 2 miles from expressway access will have a lower per unit price. Previous research into industrial land value in Chicago has indicated that access to a major expressway is an important determinant of value.

Site Variables: The site variables of the model are AGE and COND. AGE is the age of the structure on the parcel calculated by subtracting the reported construction year in the REDI/Harris file from 1995. The average age of structure in the redeveloped group is 54.3 years, and the average age of a structure in the control group is 54.0 years. The expectation is that the value of the parcel will decline with increasing age of the structure on the parcel. COND is the condition code of the structure provided in the REDI/Harris data. It ranges from a value of 1 to 4, with I denoting a structure in excellent condition, and 4 denoting a structure in poor condition. In both the redeveloped and control groups, the range of COND is from 1 to 3. Thus all structures in both groups rate from excellent to fair condition. The mean value of COND for the redeveloped group is 1.52 with a standard deviation of .58. The mean value for the control group is 1.66 with a standard deviation of .66.

Neighborhood Variables: The neighborhood variables of the model are BLACKD and HISPND, and both variables identify the racial majority of the census tract in which the parcel is located. Both BLACKD and HISPND are dummy variables which take the value of I if the respective racial populations residing within the census tract of the parcel is greater than 75% of the total population within the census tract. Since the sales of both groups range from 1983 to 1993, both the 1980 and 1990 Census statistics were used to calculate the racial composition of the census tracts. For parcels with sale dates in between 1980 and 1990, an interpolated value between the reported 1980 and 1990 census figures at the time of sale date was used to identify racial percentages. For sale dates after 1990, the 1990 Census figures were used.

Economic Trend Variables: The economic trend variables of the model include DAYS, DAYSQ, and UNEMPRTD. UNEMPRTD is a dummy variable which takes on the value of I if the monthly Chicago metropolitan unemployment rate as reported by the Illinois Department of Employment Security at the time of the parcel's sale date is less than 10%. This variable is designed to identify periods of recession. The expectation is that during recessionary periods, land values will decline to account for decreased demand. DAYS is the number of days of the sale date from the sale date of the first observation in the redeveloped group, which is August 1, 1983. A quadratic expression of the variable is designed to identify any non-linear, long-term trends in the real sale prices of the parcels.

Environmental Variables: As previously discussed above, the three environmental variables are proposed to represent the vector, E, which represents the likely severity of environmental contamination and are posited to be determinants of the unobservable contamination liability lottery faced by the buyer and the seller. These three variables are PROBCON, EPASIC, and TRISIC. PROBCON is a continuous variable and represents the a priori probability of parcel contamination given the historical land use of the parcel. Each observation was researched in the 1975 and 1949 Sanborn Fire Insurance Maps, and an interpretation of the parcel's historical land use was made. Given the historical land use, each parcel was assigned a value of the a priori probability of contamination, as specified by Noonan (1992). Noonan surveyed 17 environmental engineering firms and calculated contamination probabilities based on the cleanup histories of these 17 firms.4 Table I outlines the probability of contamination for the 25 categories of land use as published by Noonan. The mean values of PROBCON for the redeveloped and current-use groups were nearly identical--0.6785 for the redeveloped group and 0.6749 for the current-use group. This similarity between the two data groups could be interpreted as providing prior indication that contamination liability does not hinder redevelopment per se.

Specification of the Logit Model

To determine the various impacts on the probability of redevelopment, a logit analysis is conducted. The logit model is conceptually similar in approach to an ordinary least squares regression; however, the logit model is generally preferable for models where the dependent variable is binary--that is either a I or a 0. A basic discussion of the logit functional form is presented in Appendix B. For the logit analysis, the two groups of data--the redeveloped group and the current-use group--are now pooled into one dataset. The dependent variable of the logit models to be estimated is the dummy variable, REDEVDUM, which takes on the value of I if the observation is from the redeveloped group and 0 if the observation is from the current-use group. Thus, the estimated values of the dependent variable of the logit equation can be interpreted as the probability of redevelopment occurring contingent upon a sale. The explanatory variables to be included in the various logit models to be estimated include VALDIFF, PROFRT, BLACKD, BIGD, and **PROBCON.**

- VALDIFF is a continuous variable and is the value differential calculated from the estimated redeveloped and current-use value functions derived from the two regression models. VALDIFF is defined as $(V^R - V^C)$, and the values of VALDIFF are in real 1995$ divided by 10,000. Thus each unit of VALDIFF represents a $ 10,000 increase in the magnitude of real economic profit to be captured by converting a given parcel to a new use. PROFRT is also a continuous variable and is conceptually identical to VALDIFF, however the gain is expressed as a percentage change from the current-use value. It can be understood to represent the potential rate of profit to be earned by the landowner selling the parcel for redevelopment. PROFRT is defined as $(V^R - V^C)/V^C$. Logit models will be specified using both measures of value gain, as there is a debate whether investors respond to the magnitude of profits or to the rate earned on the principle investment. The expectation, consistent with previous empirical research, is that there is a positive relationship between increased value differential or profit rate and the probability of redevelopment.

- BLACKD is a dummy variable which takes the value of I if the black population residing in the parcel's census tract location is greater than 75%. This is the same variable included in the

4 Noonan's results were gathered on a voluntary basis, and he cautions that the possibility for survey bias exists since it is possible firms were motivated to present environmental testing and cleanup in a favorable light.

value equations. It is again included in the logit function to investigate whether there is any investor bias against black areas while controlling for contamination risk, and after controlling for its effect in the value functions. The conventional wisdom is that there is a redlining against black neighborhoods, and the expectation is that there is a negative relationship between BLACKD and the probability of redevelopment. A negative relationship in the logit equation would imply that investors are willing to give up profits to avoid locating in areas of high black population.

- BIGD is a dummy variable that takes on the value of I if the land area of the parcel is greater than 50,000 square feet. This is just slightly more than I acre. The inclusion of this variable follows the conventional wisdom that one of the major competitive disadvantages of the urban area versus greenfield locations is the City's lack of large industrial tracks of land that can accommodate the current preferences of industrial producers. The expectation is that larger tracks of land will have a higher probability of redevelopment.

Empirical Results

The Redeveloped Value Equations: The results of the various specifications of the redeveloped value equations are presented in Table 3. As presented in Appendix A, the functional form of the value equations to be estimated has been derived from a Cobb-Douglas production function for industrial real estate. The coefficient of LNA is negative and is significant, indicating that the per square foot unit price declines with increasing land area. The coefficient of LNA also equals (α + β - 1) where a and P are the elasticities of land value to land area and floor space respectively. Making this calculation reveals that for redeveloped industrial real estate, the elasticity of land value to land area is .416. The coefficient of LNCAPINT is very small in magnitude and is not statistically significant. However, the estimated value of the elasticity of land value to floor space is .027. This indicates that the production function for a quantity of industrial real estate for redevelopment is primarily a function of land area and not a function of the structure floor space. Thus, the value function for redeveloped industrial real estate is derived:

$$V^R = L^{.416} S^{.028} e^{9.306 + \gamma X}$$

where: L = land area.

S = structure floor space.

γX is the vector of other explanatory variables.

The influence of CBD on the unit price is substantial and statistically significant. The CBD variable also determines whether a parcel has an INRING or an OUTRING location. Both WRING and OUTRING have a large and statistically significant contribution to the unit price. On average, there is a 25.14% decline in the per unit price of land for each additional mile from the central business district5. Also, on average, a parcel with middle ring location (in between 5.5 and 9.5 miles from CBD) gains 192% of value compared to an inner-ring location. Further, on average, a outer-ring location gains 148% increase in unit price from a middle-ring location. The fourth locational variable, LNORTHD, also has a marked and significant positive effect on per unit price.

5 Note that this result for CBD is contrary to the findings of most previous empirical studies of industrial land value.

A north location relative to a south location gains 84.17% in value on average. The significance of these four locational variables indicates that the modelling of Chicago's industrial real estate market into 6 distinct submarkets is a useful subdivision of the market. Somewhat surprisingly, the coefficient of last locational variable, INTCHGD, is not statistically different from zero.

Of the site specific explanatory variables, only COND is statistically significant. Each unit increase of the condition code from 1 to 3 increases a parcel's per square foot unit price by 54.6%. The variables AGE, UNEMPRTD, and INTCHGD are not statistically significant, and the null hypothesis that their coefficients are zero cannot be ruled out. The quadratic time trend variables, DAYS and DAYSQ, are strongly significant and their impact on unit price is quite substantial. This supports the view that there has been a long-term trend in the real price of industrial real estate over the last 10 years. An analysis of the coefficients of DAYS and DAYSQ indicate a peak in the unit price on June 15, 1989. This date is consistent with the peak of the high economic growth period in the late eighties. The greatest percentage increases in unit price occurred in the first two years of the data. On average, during the first year from 8/1/83 there was an 84% increase in the unit price. During the second year, there was a 64% increase in the unit price. After 6/15/89 there is a decline in unit prices on average. The greatest decline was from 8/1/92 to 8/1/93, where on average there was a 33.4% decline in the real prices of industrial parcels, all other things remaining constant.

The neighborhood variable BLACKD has a substantial and significant effect on unit prices. On average, all else held constant, industrial parcels in census tracts of greater than 75% black population commanded a unit price 42.7% less than similar parcels in areas of lower black population. However, the other neighborhood variable, HISPND, is not statistically significant. It appears that neighborhoods of high hispanic percentages have no effect on industrial land value one way or another.

The last and most important variables for this study, PROBCON, EPASIC, and TRISIC, show mixed results regarding their impact on unit price. PROBCON is significant to the 10% level; however EPASIC and TRISIC are not significant. When EPASIC and TRISIC are removed from the equation (Model VR2 in Table 3), the significance of PROBCON improves slightly, and there is a small improvement in the explanatory power of the redeveloped model, as the adjusted R2 increases from .6161 to .6252. The contribution of PROBCON to the explanatory power of the model can be seen when it is removed from the model specification altogether (Model VR3 in Table 3). The inclusion of PROBCON improves the adjusted R2 one percentage point, from .6154 to .6252. The impact of the a-priori probability of contamination on industrial land value is substantial. The unit price increases, on average, 76%, over the observed range of PROBCON from a probability of 0.99 to a value of 0. 13. Interpolating this relationship over the probability range from I to 0, one can infer that a cleanup which eliminates all future probability of contamination increases the per unit price by 93%. The average sale price in 1995 dollars of a redeveloped parcel is $846,930. Also, the average prior contamination probability is .68 for a redeveloped parcel. On average, investors are discounting their bid price by 36% or about $477,000. So, one can infer that the cleanup of an average parcel where the probability of contamination is then 0 would increase the unit price of the parcel by 56.3%, again, on average, increasing parcel total value by $477,000.

<u>The Current-Use Value Equations:</u> The results of the two specifications of the current-use value equations, VC I and VC2, are also presented in Table 3. The coefficient of LNA is negative and is

significant indicating that the per square foot unit price declines with increasing land area. As discussed above, the coefficient of LNA equals ($\alpha + \beta - 1$) where α and β are the elasticities of land value to land area and floor space respectively. Making this calculation reveals that for industrial real estate sold for current use, the elasticity of land value to land area is .300. In a striking difference from the redeveloped model, the coefficient of LNCAPINT is very large in magnitude and is statistically significant. The estimated value of the elasticity of land value to floor space .44 1. This indicates that the production function for industrial real estate for currentuse is a function both of land area and structure floor space. Thus, from the regression results, the value function for current-use industrial real estate is derived:

$$V^C = L^{.300} \quad S^{.441} \, e^{6.924 + \gamma X}$$

where: L = land area.

S = structure floor space.

γX is the vector of other explanatory variables.

The influence of CBD on the unit price is also substantial and statistically significant for the parcels sold for current-use. Only OUTRING has a large and statistically significant contribution to the unit price. INRING is not significant. On average, there is a 15.7% decline in the per unit price of land for each additional mile from the central business district. On average, an outer-ring location gains 148% increase in unit price from a middle-ring location. The fourth locational variable, LNORTHD, also has a marked and significant positive effect on per unit price. A north location relative to a south location gains 41.7% in value on average. The significance of these three locational variables indicates that for the current-use market, there are four distinct industrial real estate submarkets, rather than the 6 distinct submarkets identified for the redeveloped market. The coefficient of last locational variable, INTCHGD, is not statistically different from zero.

Of the site specific explanatory variables, only COND is statistically significant. Each unit increase of the condition code from 1 to 3 increases a parcel's per square foot unit price by 29.6%. AGE is not significant; however, if it were, the impact of AGE on unit price is very small. The unit price declines by only 0.6% for each additional year of structure age. The variables UNEMPRTD, and INTCHGD are not statistically significant, and the null hypothesis that their coefficients are zero cannot be ruled out. The quadratic time trend variables, DAYS and DAYSQ, are not significant, but they are nearly so. Calculating the impact of these two variables on current-use unit price reveals a striking similarity to the redeveloped group. The coefficients of DAYS and DAYSQ indicate a peak in the unit price on June 26, 1989. This date is within 11 days of the redeveloped group and consistent with the peak of the high economic growth period in the late eighties.

The neighborhood variable BLACKD also has a strong effect on current-use unit prices. On average, all else held constant, industrial parcels in census tracts of greater than 75% black population commanded a unit price 48.2% less than similar parcels in areas of lower black population. This is consistent with the figure of 42.7% for the redeveloped group. Again, the other neighborhood variable, HISPND, is not statistically significant for the current-use group.

The vector of three environmental variables, PROBCON, EPASIC, and TRISIC, are all not statistically significant. The removal of these three variables from the current-use value model specification, Model VC2 in Table 3, improves the model's explanatory power slightly, with a 1 point gain in the adjusted R^2 value. The lack of significance of the environmental variables in the current-use model lends support to the view that contamination risk has a greater impact when the property is being redeveloped. Clearly, the results show here that sales where only an exchange of ownership occurred and no evidence of redevelopment is apparent, contamination risk is not a significant determinant of value. This is consistent with the conventional wisdom that contamination risk becomes more an issue when there are substantial changes to a property and the likelihood of the release of contamination to the environment is greater.

The Logit Equations: The results of the various specifications of the logit equations are presented in Table 4. The dependent variable of the logit models is the dummy variable REDEVDUM, which takes on the value of I if a parcel is among the redeveloped observations and 0 if it is among the current-use observations. Therefore the estimated values of the dependent variable in the logit equation can be interpreted as the probability of redevelopment occurring contingent upon a sale occurring. In logit model 1A in Table 4, the impact of Value Differential, VALDIFF, on the probability of redevelopment is statistically significant; however, its impact is somewhat small in magnitude. Each unit of VALDIFF (which represents a $10,000 increase in magnitude of profit) increases the probability of redevelopment approx .00 16 percentage points. All else held constant, if the probability of redevelopment is .5 at VALDIFF=O, the probability approaches .75 if the parcel has a total value differential of 153 or of about $1,530,000. Expressed another way, the probability of redevelopment will increase one percentage point for each additional $60,000 in value differential. The other variables in the model specification, BLACKD and BIGD, both have substantial and significant effects on the probability of redevelopment. Even after accounting for BLACKD in the land value functions, a parcel location in a census tract of black population greater than 75% has a 16.8% less probability of redevelopment contingent upon a sale occurring. Thus, there is evidence here to support the view that there is some kind of investor bias against black areas of the City. Properties of land area greater than 50,000 square feet have an 18.4% higher probability of redevelopment contingent upon a sale occurring. The prior contamination probability is not significant. Its removal from the logit specification is Model I B makes nearly no change in the other coefficients magnitude or significance.

Nearly identical results are obtained when the variable, PROFRT, is used. In logit Model 2A, the effect of PROFRT is significant; however, like VALDIFF, its effect is not large in magnitude. On average, a one percent increase in the profit rate increases the probability of redevelopment 0.07% One needs an approximate increase in profit of about 13% to achieve a 1% increase in the probability of redevelopment.

Conclusions and Policy Recommendations

The results of this study support three major conclusions. First, this study provides further evidence to support value differential theory in the industrial land market. Also, however, the results present compelling evidence to support the view that the profit rate is also a significant determinant of the probability of redevelopment. The bottom line here is that there is evidence that investors respond to both magnitudes of profit and the rates of profit in the industrial real estate market. However, the overall effect of both value differential and profit rate to the probability of redevelopment is not large. In the logit model, a rough estimate is that an additional $60,000 dollars in total profit will increase the probability of redevelopment by only I percentage point. Thus high probabilities of redevelopment occur only when there are very large profits to be captured through conversion of a property to a new industrial use. Without statistical significance of the two measures of investor profit, any further discussion of the impacts on the probability of redevelopment would be without convincing empirical support.

Second, using the functional form derived from the Cobb-Douglas functional form, this study also provides evidence that the redeveloped properties are indeed fundamentally different form the current-use properties. As would be expected, land area and locational variables are significant determinants of value for the redeveloped group and the current-use group. The marked distinction between the two data groups is that the site variables are much stronger in magnitude and significance for the current-use group, and the capital intensity variable is significant only for the current-use group. This result suggests that when a property is purchase for current-use, developers are purchasing a site and its fixed capital. Both land and capital have significant contributions to the "quantity" of industrial real estate. On the contrary, when a property is purchased for redevelopment, developers appear to be responding only to the site, and not to the amount of fixed capital. The empirical results of this study lend support to the view that industrial real estate developers are providing two distinctly different real estate products: 1.) industrial sites being provided for redeveloped use and 2.) industrial site with usable fixed capital being provided for current-use.

Investigating the difference in the two data groups also gives some insight to this difference. The two data groups are remarkably similar in many ways; however, the redeveloped parcels are of larger land area and smaller building floor space than the current-use parcels. Also, redeveloped properties sell for a higher real price, on average. Additionally, the current use parcels tend to be of lower total value and of higher capital intensity than the redeveloped group. Table 5 below outlines some of the marked differences between the redeveloped parcels and the current-use parcels.

Table 5

Comparison of Statistics of Redeveloped and Current-Use Data Groups

	Variable	Mean Value	Std. deviation	Maximum Value
Redeveloped Parcels (N=95)	S Sale Price (95$)	$846,930	$1,346,438	$11,345,632
	Land Area (sqft)	82,905	158,991	1,416,000
	Floor Space (sqft)	51,737	63,603	343,000
	Capital Intensity	1.26	2.01	15.53
Current-Use Parcels (N=99)	Sale Price (95$)	$664,388	$884,067	$5,328,366
	Land Area (sqft)	57,004	124,983	816,900
	Floor Space (sqft)	57,601	101,884	725,100
	Capital Intensity	1.63	2.23	17.83

The fundamental question of importance for the City of Chicago, and for this study, is: Will cleaning up a site make the site again competitive in the industrial real estate market in the City, and does it make financial sense for the City to publicly fund cleanups of industrial sites? If one assumes that cleaning a site of contamination eliminates all likelihood of future contamination risk and the prior probability of contamination goes to zero, on average the City can expect a 56.3% gain in the per square foot unit price of the property. Given that the average sale price of a redeveloped parcel in 95$ is $846,930 and given that the average prior probability of contamination of a redeveloped parcel is about 68%, if on average gains are about 56.3%, then one could expect a total gain of about $477,000. When this figure is compared to the cleanup cost history published by Noonan (1992), we find that total phase I testing, phase II testing, and contamination cleanup costs ranged in 1995$ from approximately $114,000 to a maximum of $970,000 with a mean value of $352,000.6 The average gain in value is well within the cost range reported by Noonan. Put another way, looking at the results historically, the discounts in land value due to contamination risk appear to be consistent with the limited cost data available. Thus, the third conclusion of this paper is that there is no strong evidence to support the view that a city-funded clean-up would markedly increase the probability of redevelopment outside of the clean-up's effect on land value. This red flag should discourage any expectation that contamination remediation could be credited with attracting jobs to the City. However, there is evidence to support the view that gains in property value might be sufficient to justify a publicly funded cleanup, but only after some serious scrutiny of the parcel in question. For certain properties very close to the margin, the gain in land value might indeed achieve enough of an increase in value and in the probability of redevelopment to bring a property back into a more competitive position. According to the results of the logit model, an average gain of $477,000 would translate to an increase in the probability of redevelopment of about 9%. However, caution is advised. Large gains in the probability of redevelopment from site contamination clean-up are most likely not a reality. The gain to the city should be viewed as strictly fiscal gains associated with a rise in property value. The industrial land market is highly competitive in the City of Chicago, and, from the evidence presented, it appears that the market has successfully valued and capitalized the contamination liability externality. Contamination risk does not appear to eliminate a parcel from the market, and cleaning up a site by the city will not correct a fundamental "market" failure. On a technical note, the variable, PROBCON, is the only significant variable of the three environmental variables proposed to represent E. Thus, it can be concluded that the prior probability of contamination, PROBCON, is a significant determinant of a parcel's contamination liability lottery. Technically, it is the valuation estimate of the lottery that is capitalized into land value.

However, the results of this study do not entirely lend support to Boyd et. al.'s information asymmetry story. Clearly, developers are deeply discounting properties that have a high probability of prior contamination. However, prior contamination is not a significant determinant of property value remaining in current-use. Although there is this difference between the groups of data, one cannot conclude that investors are overestimating the liability they face. On the contrary, the discounts are well in line with the limited cleanup cost data available. The bottom line is that the information asymmetry explanation for reductions in transactions cannot be ruled out. Much more work needs to be done to estimate in total the discount buyers expect compared to the total clean-up costs required.

What stands out in the results is that redevelopment activity is substantially affected by the racial mix of the census tract of the parcel in question. There is strong evidence here to support the view that developers are willing to forego profits to avoid areas of higher black population

6 No information is yet available about the size of the parcels in Noonan's clean-up cost sample.

percentages, and this is after accounting for race in the value functions. It is important to emphasize, however, that these results do not provide evidence of overt racism. Certainly, more work needs to be done to ascertain if it is indeed only race that investors are responding to, or if it might be some other externality that is perceived by investors to impose substantial costs--such as high crime rates and the related high insurance rates--that are known to be correlated with areas of high black population. The results of this study also provide evidence that major increases in the probability of redevelopment might occur if parcels could be assembled into larger tracts of land area greater than 50,000 square feet. Such a result might be interpreted as lending support for a land banking program. The logit analysis shows that developers are willing to forgo profits to obtain parcels of land area greater than 50,000 square feet in the City of Chicago. On average, the probability of redevelopment increased a substantial 18 percentage points for parcels with land area greater than 50,000 sq. ft. This analysis supports the view that the lack of large parcels might be more a contributing factor for the City's competitive disadvantage versus greenfield locations than is the perceived contamination risk problem. Also, this research supports the view that investing public dollars into combining industrial parcels into larger land areas greater that 50,000 sq. ft. can be justified by likely gains in employment.

In summary, the contribution of this empirical research is threefold: First, it is the third empirical study to find strong evidence to support value differential theory, and the first to use this theory to investigate an important urban policy question--Does contamination risk have an effect on urban industrial land markets? Second, this study provides a significant improvement in the estimation of the bid rent function for manufacturing in the City of Chicago, identifying distinct differences in the determinants of land value of parcels for sold for current-use versus parcels sold for redevelopment and estimating production functional forms for both groups of property. Third, it provides the first empirical estimate of both the likely gains in land value and finds that an increase in the probability of redevelopment will most likely not be gained as a result from publicly-funded contamination remediation within an urban area.

Lastly, this research has assembled a unique database of industrial property within the City of Chicago, and the results presented emerge from intense exploration of the data. Even though the findings of this paper are consistent with previous research and general expectations, they should not be interpreted as the final answer to the question of the impact of contamination risk on industrial redevelopment. One important characteristic of the dataset is that all properties have been sold to a new owner. It is a possibility that these properties represent only the best properties, and the selection screen devised may not be capturing the contaminated properties in question. Properties with actual severe contamination problems may never have made it to the market. A next step for this research would be to have actual case histories documenting any contamination problems and remediation for the properties in the dataset. Once actual contamination and/or clean-up information has been assembled for each parcel, a more conclusive answer to the contamination risk question can be prepared. Notwithstanding this issue, this research clearly sets a standard for the theoretical base of approaching this problem, and the empirical results of this research have generated a number of hypotheses and directions for future research into this question.

Appendix A: Functional Form of the Regression Model

This section discusses the functional form used to represent the value functions of both the redeveloped group and the control group, VR and VC respectively. One of the hypotheses of this study entails identifying any differences in magnitude and significance of the vector of environmental variables, E, of the redeveloped group from the control group. Thus, it is necessary that an identical valuation model will be used to estimate both groups of data. Using an identical model would identify any fundamental differences in the determinants of value between the two groups. Therefore, it is necessary that the functional form used have a theoretical base which captures what the redeveloped group has fundamentally in common with the current-use (or control) group.

Assume that an industrial producer in an urban area produces output with the standard production function whereby output is a function of land, capital, and labor:

$$Q = Q\ (L, K, N)$$

McDonald (1981) has proposed that it may be necessary to separate the capital input into two components: floor space, S, and other capital, M, such as machinery and equipment, and that also land area, L, and floor space, S, can be nested together to produce a factor input called industrial Real Estate, R_{Ind}. So the production function can be rewritten:

$$Q = Q\ [\ R\ (\ L, S\ ), M, N\ ]$$

A simplifying assumption that facilitates empirical analysis is that of weak separability of L and S from M and N. McDonald (1981) identifies that if the marginal rate of substitution of L for S is independent of the amounts of M and N, then on can examine the market for R for use in the industrial sector separately from the other factor markets.

Assume that developers of industrial real estate are providing an output which is a factor input for industrial producers in an urban area. Therefore, every industrial location can be represented as a quantity of industrial real estate, R_{Ind}, and can be written:

$$R_{Ind.} = R\ (L, S)$$

A simplifying assumption is that the marginal rate of substitution of land for floor space is 1[7]. This assumption allows a Cobb-Douglas production functional form to be used:

$$R_{Ind.} = L^{\alpha}\ S^{\beta}$$

The value of a given parcel of industrial real estate would be the quantity, $R_{Ind.}$ time the unit price, $P_{IRE.}$, per each unit of industrial real estate, whatever those units might be. Also, the per unit price, P_{IRE}, is a function of the numerous locational, site, neighborhood, and economic variables that distinguish different markets and market conditions. This is consistent with the functional

7 McDonald (1981) estimated that the marginal rate of substitution between land, L, and floor space, S, for industrial real estate was about .77 in an empirical analysis of industrial land in Melbourne, Australia.

form proposed by Mills (1971). Therefore, the value of industrial real estate can be written as follows:

$$V = P_{IRE} \;\; x \;\; R_{Ind.}$$

$$(P_{IRE}\, e^{\gamma o + \gamma X}) \;\; x \;\; (L^{\alpha} S^{\beta})$$

$$UP = V / L$$

$$= (P_{IRE} / L) \;\; x \; [L^{\alpha} \;\; S^{\beta} \quad e^{\gamma o + \gamma x}]$$

$$= \quad P_{IRE} \;\; x \;\; \{[L^{\alpha} \;\; S^{\beta}\, e^{\gamma o + \gamma x}] / \;\; L^{1-\beta} \;\; L^{\beta}\}$$

$$= \quad P_{IRE} \;\; x \;\; [L^{\alpha + \beta - 1} \;\; (S / L)^{\beta}\, e^{\gamma o + \gamma x}]$$

Dividing by land area, L, would produce an expression for the per square foot unit price, UP, of the industrial real estate. Note that UP is different from PIRE, which is the price per unit of R, which is unknown. The expression for UP is written as follows:

Taking logs, the functional form to be estimated is derived:

$$\ln UP = [K] + \delta \ln L + \beta 1n\, (S / L) + \gamma X$$

where K = constant = [$\ln P_{IRE} + \gamma o$]
$\delta = (\alpha + \beta - 1)$
X = vector of variables determining the variations in the unit price of industrial land.
S / L = capital intensity or land use intensity of the parcel.

If developers of industrial real estate view property for redevelopment to be a fundamentally different product from current-use property, the above derived functional form should reveal these differences through the estimated production functions. Therefore, the expectation is that the coefficients, α and β, which represent the elasticity of land and building area to the unit price, will be different for each group.

Appendix B: Logit Models

When the dependent variable of a model is set up as a 0-1 dummy variable and regressed on the explanatory variables, one would expect that the predicted values of the dependent variable to fall between the interval of 0 and 1. This suggests that the predicted value of the dependent variable could be interpreted as a probability. When an ordinary least squares regression model is used, it is possible to have estimated probabilities outside the 0-1 range. One method of squeezing the estimated probabilities inside the 0-1 interval without actually creating probability estimates of 0 or I is to use the logistic function, or the logit model. In the logit model, a linear function of the explanatory variables can be shown to be equal to the logarithm of the probability ratio of the two states defined by 0 and 1. The functional form of the logit model is:

$$\mathit{Prob\ (Y = 1)} = \{ (e^{B'x}) / (1 + e^{B'x}) \} = \wedge (B'x)$$

Graphically, the logit function is represented as follows:

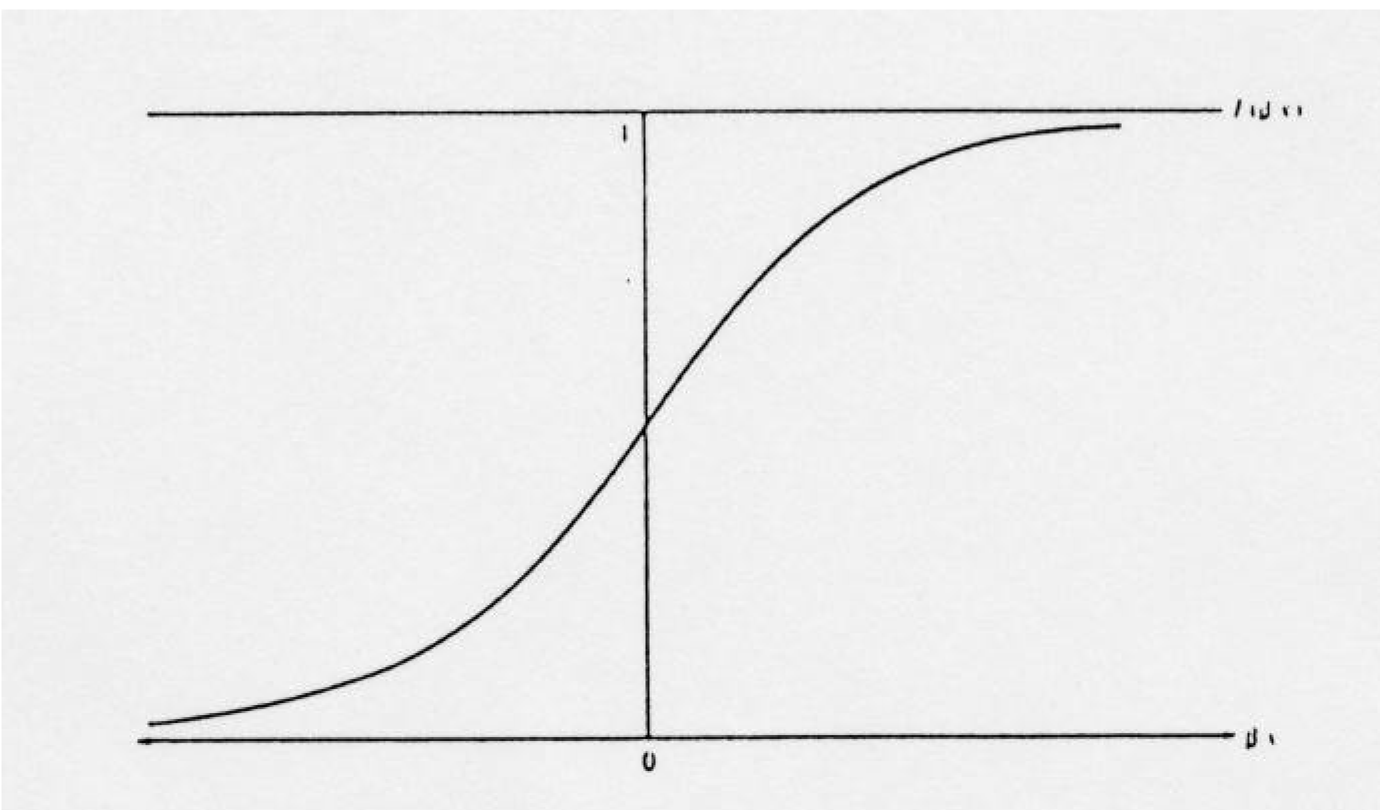

FIGURE 1 - REDEVELOPED PARCELS (N = 95)

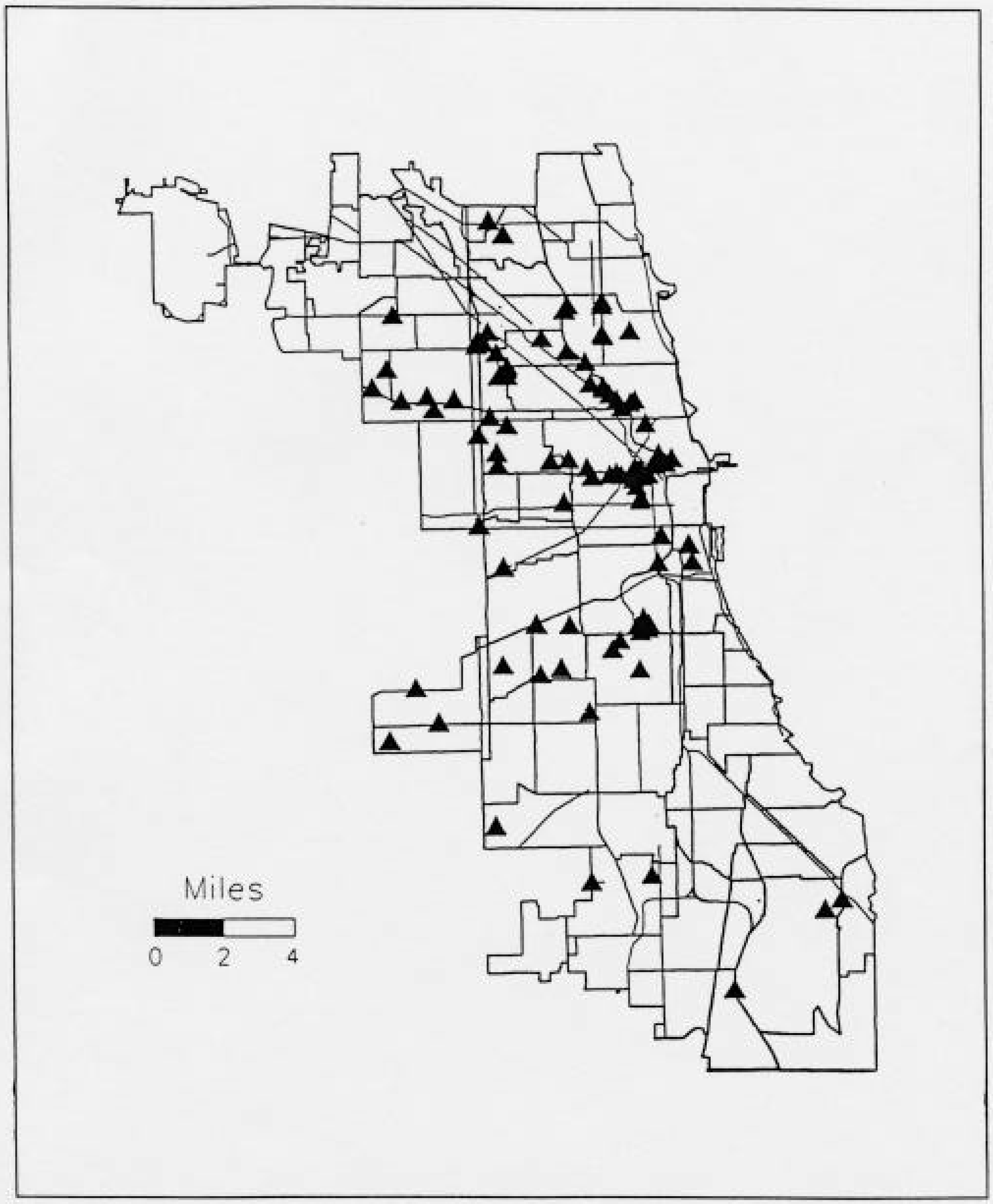

FIGURE 2 - CURRENT-USE PARCELS (N = 99)

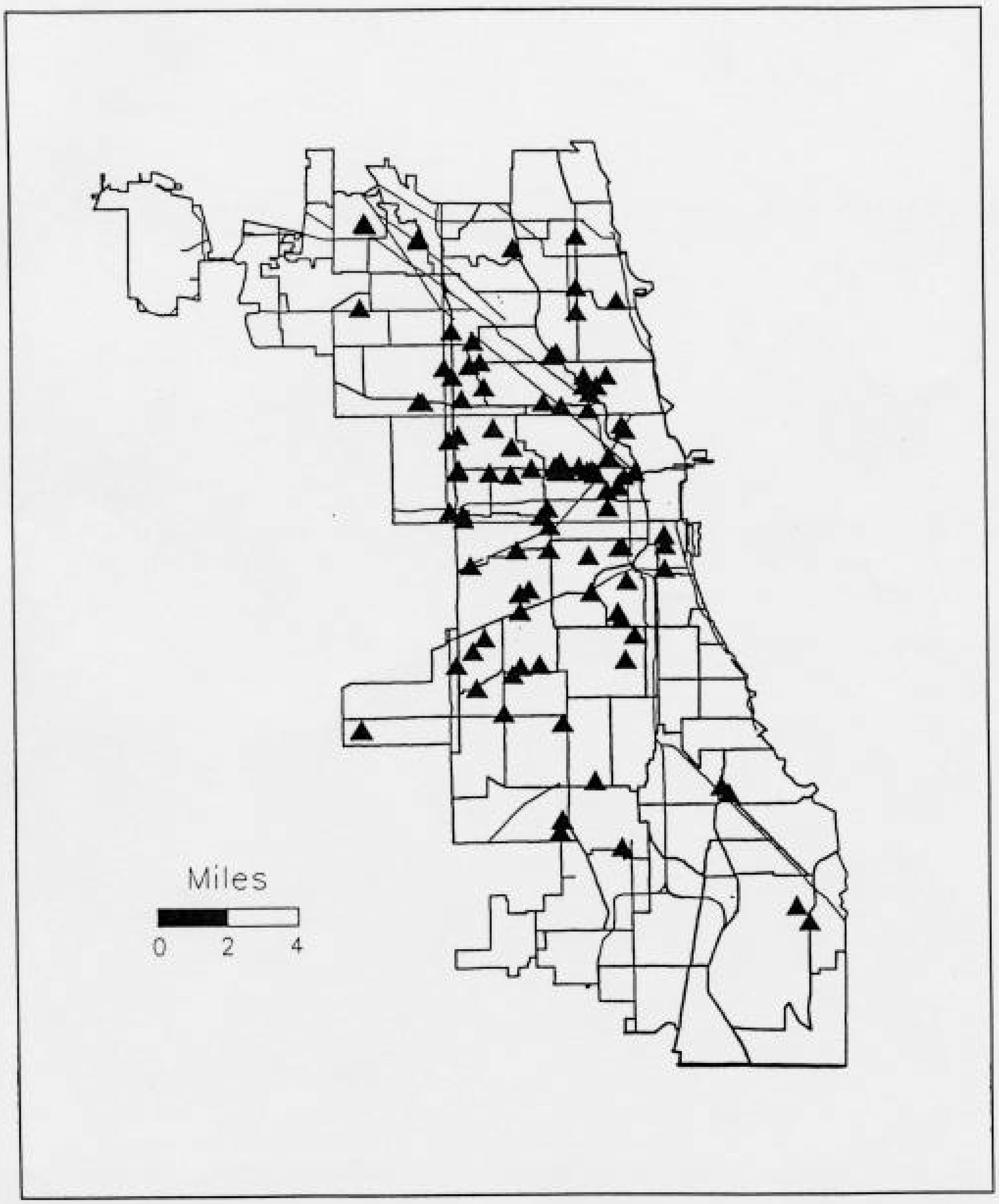

Table I

Prior Probability of Contamination Based on Land Use

Commercial and Industrial Land Use Categories	Prior Contain Probability
1. Former coal gas plants, fuel distributors, chemical distributors, airports, incinerators	.99
2. Auto salvage yards, plastic manufacture, electric utility, refining, hazardous waster storage/transfer	.95
3. Oil and other petroleum storage	.92
4. Metal plating, landfills, chemical manufacture, metal finishing/tool & dye, laboratories	.90
5. Heavy industrial manufacturing, power plants, paper manufacturing, gas stations	.88
6. Tanneries	.87
7. Urban vacant/abandoned land, furniture repair and stripping, circuit board manufacturers, tank farms, waste treatment plants	.85
8. Metal working and fabrication	.83
9. Railroad yards and right of ways, vehicle maintenance facilities	.82
10. Refuse recycling facilities, machine shops, electronics assembly facilities, agricultural mixers/formulators, high technology manufacturing	.80
11. Junk-yards, electronics manufacture	.79
12. Industrial parks, automotive assembly facility, light industrial manufacturing	.75
13. Dry cleaners	.74
14. Auto repair shops	.72
15. Chemical research facility	.70
16. Trucking terminal, textile printing and finishing	.65
17. Resource recovery facilities, electrical/plumbing/HVAC service	.60
18. Photographic	.53
19. Auto dealerships, fabric dyeing establishments, pharmaceutical establishments	.50
20. Highways, research facilities	.40
21. Warehouses	.35
22. Gas utilities	.35

23. Retail property	.25
24. Residential, rural vacant property, hospitals	.20
25. Offices (nonmanufacturing)	.13

Table 2-A

Redeveloped Parcel (NR=95)

Variable	Description	Mean	Std. Dev.	Minimum	Maximum
LNUP	Natural log of per s.f. real unit price.	2.5150	1.2315	-1.5076	5.2016
LNA	Natural log of Land area in square feet.	10.5885	1.1977	7.9010	14.1633
LNCAPINT	Natural log of capital intensity.	-0.6958	2.5241	-16.00008	2.5241
CBD	Distance to CBD is miles.	5.7687	2.8966	0.8700	13.3600
INRING	1 if CBD < 5.5 miles.	0.4632	0.5013	0	1
OUTRING	1 if CBD > 9.5 miles.	0.1579	0.3666	0	1
LNORTHD	1 if parcel location is north of Lake St.	0.6316	0.4849	0	1
AGE	Age of building in years.	54.2947	23.9720	5.0	120.0
COND	Condition Code of structure.	1.5158	0.5809	1.0	3.0
UNEMPRTD	1 if Chicago unemployment rate< 10%.	0.9158	0.2792	0	1
INTCHGD	1 if distance to interchange is > 3 miles.	0.0632	0.2445	0	1
DAYS	4 of days parcel sale date from 8/1/83	1877.34	862.15	0.00	3780.00
DAYSQ	(DAYS)'	4259879	3457736	0.00	14288400
BLACKD	1 if census tract population > 75% black.	0.1158	0.3217	0	1
HISPND	1 if census tract population > 75% hispanic	0.0526	0.2244	0	1
PROBCON	A priori probability of contamination.	0.6785	0.2248	0.13	0.99
EPASIC	1 if SIC code is among Illinois EPA Cleanups.	0.1579	0.3666	0	1
TRISIC	1 if SIC code is among Cook County TRI releases.		0.0737	0.2626	0

Other Statistics of Importance

Variable	Description	Mean	Std. Dev.	Minimum	Maximum
REALP95	Parcel sale price in 1995 dollars.	$846,930	$1,346,438	$15,116	$11,345,632
LAREA	Land area in square feet.	82,905	158,991	2,700	1,416,000
BIGD	1 if land area is > 50,000 square feet.	0.4211	0.4963	0	1
SFSPACE	Structure floor space in square feet.	51,737	63,603	0	343,000
UP95	Per square foot unit price in 1995 dollars.	$23.35	$30.65	$0.22	$181.58
CAPINT	Capital intensity = SFSPACE/LAREA.	1.2632	2.0079	0	15.5274

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8 Two of the redeveloped parcels were vacant, therefore these two observations had a capital intensity of zero. The Ln(CAPINT) has been arbitrarily assigned the value of - 16.00 for these two observations. The actual minimum of LNCAPINT is -3.1653. Additionally the actual minimum SFSPACE is 1,200 s.f. and minimum CAPINT is 0.0422.

Table 2-B

Current-Use Parcels (NR=99)

Variable	Description	Mean	Std. Dev.	Minimum	Maximum
LNUP	Natural log of per s.f. real unit price.	2.6347	1.0695	-1.0307	5.2588
LNA	Natural log of Land area in square feet.	10.1142	1.1031	7.3778	13.6133
LNCAPINT	Natural log of capital intensity.	0.0048	0.9909	-3.0285	2.8811
CBD	Distance to CBD is miles.	5.4783	2.7145	1.2000	12.6700
INRING	1 if CBD < 5.5 miles.	0.5253	0.5019	0	1
OUTRING	1 if CBD > 9.5 miles.	0.1111	0.3159	0	1
LNORTHD	1 if parcel location is north of Lake St.	0.4848	0.5023	0	1
AGE	Age of building in years.	54.0200	23.5100	5.0	106.0
COND	Condition Code of structure.	1.6566	0.6572	1.0	3.0
UNEMPRTD	1 if Chicago unemployment rate< 10%.	0.8383	0.3700	0	1
INTCHGD	1 if distance to interchange is > 3 miles.	0.0303	0.1723	0	1
DAYS	# of days parcel sale date from 8/1/83.	2173.50	1028.50	243.00	3957.00
DAYSQ	(DAYS)2	5771890	4680386	59049	15657849
BLACKD	1 if census tract population > 75% black.	0.2929	0.4574	0	1
HISPND	1 if census tract population > 75% hispanic	0.0808	0.2739	0	1
PROBCON	A priori probability of contamination.	0.6749	0.2245	0.13	0.99
EPASIC	1 if SIC code is among Illinois EPA Cleanups.	0.1919	0.3958	0	1
TRISIC	1 if SIC code is among Cook County TRI releases.		0.0808	0.2739	0 1

Other Statistics of Importance

Variable	Description	Mean	Std. Dev.	Minimum	Maximum
REALP95	Parcel sale price in 1995 dollars.	$664,388	$884,067	$5,851	$5,328,366
LAREA	Land area in square feet.	57,004	124,983	1,600	816,900
BIGD	1 if land area > 50,000 square feet.	0.2222	0.4179	0	1
SFSPACE	Structure floor space in square feet.	57,601	101,884	500	725,100
UP95	Per square foot unit price in 1995 dollars.	$23.85	$31.02	$0.36	$192.25
CAPINT	Capital intensity = SFSPACE/LAREA.	1.6328	2.2251	0.0484	17.8345

Table 3

Estimation Results

	Value Equations for Redeveloped Parcels	Value Equations for Current-Use Parcels			
	VRI	VR2	VR3	VC1	VC2
CONSTANT	9.3055	9.2235	9.1199	6.9235	6.8983
	(8.625)**	(8.832)**	(8.635)**	(6.191)**	(6.293)**
LNA	-0.5561	-0.5534	-0.5728	-0.2584	-0.2723
	(7.069)*	(7.182)**	(7.416)**	(3.235)**	(3.509)**
LNCAPINT	0.0279	0.0279	0.0206	0.4410	0.4555
	(0.841)	(0.854)	(0.626)	(4.419)*	(4.697)**
CBD	-0.2896	-0.2810	-0.2868	-0.1706	-0.1699
	(3.232)**	(3.327)**	(3.354)**	(2.191)**	(2.217)**
INRING	-1.0726	-1.0214	-1.0346	-0.3008	-0.2991
	(2.850)**	(2.979)**	(2.979)**	(0.936)	(0.945)
OUTRING	0.9096	0.9019	0.9324	0.8485	0.8748
	(2.115)**	(2.150)**	(2.196)**	(2.086)**	(2.184)**
LNORTHD	0.6107	0.6198	0.5677	0.3486	0.3042
	(3.095)*	(3.212)**	(2.939)**	(1.911)*	(1.732)*
AGE	-0.0019	-0.0019	-0.0018	-0.0065	-0.0060
	(0.474)	(0.484)	(0.456)	(1.599)	(1.512)
COND	-0.4356	-0.4313	-0.4261	-0.2590	-0.2760
	(2.845)**	(2.867)**	(2.797)**	(1.792)*	(1.943)*
UNEMPRTD	0.4623	0.4764	0.4745	-0.0986	-0.0958
	(1.378)	(1.451)	(1.426)	(0.431)	(0.431)
INTCHGD	-0.4473	-0.4674	-0.3983	0.0598	0.0076
	(1.170)	(1.250)	(1.057)	(0.124)	(0.016)
DAYS	0.00183	0.00178	0.00171	0.00058	0.00050
	(4.101)**	(4.360)**	(4.146)**	(1.460)	(1.342)
DAYSQ	-4.26E-7	-4.15E-7	-3.99E-7	-1.34E-7	-1.20E-7
	(3.772)**	(3.961)**	(3.767)**	(1.556)	(1.440)
BLACKD	-0.5566	-0.5201	-0.5647	-0.6571	-0.6584
	(1.961)*	(1.978)*	(2.13 1)*	(3.525)**	(3.582)
HISPND	0.0303	0.0224	0.0756	-0.2270	-0.2127
	(0.077)	(0.058)	(0.195)	(0.730)	(0.695)
PROBCON	-0.6574	-0.6422		-0.3961	
	(1.678)*	(1.756)*		(1.021)	
EPASIC	0.0505			-0.0214	
	(0.207)			(0.101)	
TRISIC	0.1006			0.1784	
	(0.272)			(0.589)	
Adj. R^2	0.6161	0.6252	0.6154	0.4917	.5025

Notes: The absolute value of the t-values are in parentheses. ** denotes 5 percent significance, * denotes percent significance.

The dependent variable of the value equations is the natural log of the per square foot unit sale price of the parcel.

Table 4

Structural Logit Analysis of Pooled Industrial Parcels

	Model 1A	Model 1B	Model 2A	Model 2B
CONSTANT	-0.1056 (0.416)	-0.0511 (0.529)	-0.1833 (0.728)	-0.1361 (1.348)
VALDIFF	0.00718 (3.041)**	0.00718 (3.040)**		
PROFRT			0.3291 (2.760)**	0.3291 (2.759)**
BIGD	0.7740 (3.900)**	0.7774 (3.922)**	0.6631 (3.711)**	0.6655 (3.729)**
BLACKD	-0.7022 (3.309)**	-0.6976 (3.307)**	-0.6201 (3.000)**	-0.6161 (2.998)**
PROBCON	0.00827 (0.232)		0.0716 (0.205)	
LLF	-119.24	-119.27	-120.70	-120.72

Note: The absolute value of t-values are in parentheses.

The dependent variable of the structural logit is REDEVDUM which takes on the value of 1 if a parcel was redeveloped and 0 if the parcel was sold for current-use.

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