The Impact of Location and Contamination Type on Brownfield Remediation and Redevelopment

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I. Introduction

Over the last few years, politicians have devoted more and more attention to redeveloping abandoned, idle, or underused industrial or commercial properties that are plagued by real or perceived contamination. Politicians consider these abandoned sites, known as brownfields, a means of generating tax revenue, creating jobs, revitalizing neighborhoods, and controlling suburban sprawl. Recently, President George W. Bush and Environmental Protection Agency Administrator Christie Whitman have launched a major initiative designed to aid in the redevelopment of these sites. On January 11, 2002, President Bush signed a bill into law that called for a five-year plan, on the part of the EPA, to provide up to $250 million a year to states, local governments, and Native American tribes to clean up brownfields. In short, Bush and others, believe the elimination of these brownfields can be a great benefit to a municipality both economically and socially.

Though a great deal of these distressed areas have been revived and put to some positive economic use, many more remain in disuse. Because brownfields are unequivocally bad, any analysis focusing on brownfields should aim to eliminate them at lowest cost. Though the literature on brownfields does, in fact, seem to have this objective in mind, the literature appears to have left a significant stone unturned.

As of yet, no study has been geared towards discerning what explicit circumstances are conducive to remediation. Perhaps there is good reason for this. Indeed, a firm cleans a brownfield and redevelops it, when and if the firm, all things considered, feels its revenues from the project will exceed its costs. It should be noted though, that such a cost/benefit analysis, is an inexact science at best. The extent of

cleanup required by the government, and the cost of this cleanup, can both often be difficult to determine. Further, the benefits of the redevelopment, seeing as how they are held in the future, are purely conjectural.

Thus, if a cost-benefit analysis were easily rendered, a rational, profit-maximizing firm would simply undertake all those projects for which it has been determined that benefits will exceed costs. Further, governments would craft policy accordingly. For the remaining brownfields, the ones for which the costs of remediation exceed the benefits, the government would simply provide a subsidy or tax credit to those firms willing to undertake the project. The subsidy or tax credit would be substantial enough so that the benefits of the project would now exceed the costs and the rational, profit-maximizing firm would be willing to undertake it.

Unfortunately though, in the case of brownfields, costs and benefits are not so easily calculated. Firms are forced to make remediation and redevelopment decisions based on inadequate information. Despite this, a great many brownfields have been revived. Thus, given the difficulty of cost-benefit analysis, what was it about these revived brownfields that brought about remediation? Though each case is unique, it seems likely that there is some common thread between them, some set of circumstances that tend to bring about the redevelopment of these brownfields.

Using data on brownfields in Bucks County, PA, this paper attempts to determine the specific circumstances that are most likely to bring about remediation and redevelopment. Though it is important to remember that each brownfield redevelopment project is different, it seems there is still something to be gained from making an attempt

at determining, among successful brownfield redevelopments, what circumstances tend to induce such successes.

II. Background

While there is not yet a study that aims to discern what specific circumstances are conducive to remediation, there is a small but growing literature on brownfields. Bartsch (1997), outlines a few of the traditional obstacles and some of the conventional ways of obtaining funding for brownfields, by examining a handful of success stories. Tracts of land in Minneapolis, Minnesota and Trenton, New Jersey, that were once brownfields, are now home to an electronics company and a housing development respectively. Though some specifics are outlined here, the article makes no attempt to analyze information across successfully remediated brownfields.

Franzini (1997) focuses on the problems brownfields create and the obstacles that prevent remediation. Franzini seems to believe that a large obstacle in brownfield remediation, is the misunderstanding, on the part of municipalities, of the government funding available to them and the significant benefits this funding could provide. Thus, an important independent variable in my model could be a municipality's familiarity and understanding of its access to government funds. Like many variables associated with this issue though, this one too, is difficult to quantify.

Singer (2001), contends that, "the largest impediment to redevelopment of the sites is paying the costs of remediation." Thus, for Singer, procuring the funds for remediation seems to be the primary obstacle in restoring some level of productivity to these brownfields. In order to procure such funds, Singer believes that the insurance policies of the polluting property owners should be tapped into (17-25). What should be

noted here though, is that Singer sees paying the costs of remediation as the biggest obstacle in the process. Perhaps then, certain affluent areas will be more conducive to remediation than will lesser-privileged areas. Therefore, median house values and/or median income values for the municipality in which the brownfield is located, will be one my independent variables. We will be able to see if remediation is systematically more or less likely due to the measurable characteristics of the municipality in which a brownfield is located.

Yount (1997) focuses on another means of funding. Yount's article, discusses the context in which brownfield lending decisions are made. The complex situations that arise in the process of a financial institution lending to someone interested in redeveloping a brownfield, though an interesting issue, is not of relevance here. Rather, what is of relevance is the fact that Yount places a good deal of emphasis on the ability of a brownfield developer to procure loans. For obvious reasons, it seems that developers in wealthy areas are more likely to secure loans than are developers in poor areas. Thus, we have further justification for including median income and median house values as independent variables.

In a more systematic study, Michael Greenberg, et al. (2000), took a survey of all 566 municipalities in the state of New Jersey. From this survey, the group was able to discern a few things about brownfields. Among the several insights the authors offer, the most interesting for our purpose was that, "existing policy mechanisms will work for the vast majority (vast majority meaning 90% here) of brownsfields projects." The authors make this statement based on the idea that this "vast majority" of brownfields do not,

according to tax assessors, have any notable off-site impacts and can therefore be redeveloped using conventional methods (Greenberg 728-730).

As one could probably imagine, the paper also argues that the remaining 10% of brownfields cannot be remediated and redeveloped using existing methods. The authors point out that, "The challenge of remediating brownfields located in multiple-hazard neighborhoods is daunting, particularly because brownfields remediation should be viewed in the context of the larger social and environmental justice issues in our society," (731). Given that Greenberg et al., regard some brownfields as particularly difficult to remediate due to neighborhood factors, we have even more evidence still, that, median income and median housing value, are variables worth making a part of this analysis.

Mindful of the constraints the nature of this issue imposes on our model, I feel there are two other variables that should be added. By adding a variable that captures the type of brownfield with which we are dealing, it seems likely something meaningful can be rendered. If some types of sites are more costly to remediate, the site type will predict the likelihood that owners will choose to remediate.

In order to receive liability relief from the Pennsylvania Department of Environmental Protection, sites can be remediated using one, or a combination of, four different standards. The standards are: Background, Statewide Health, Site-Specific, and Special Industrial. The "background" classification implies that the site requires cleanup to naturally occurring or historical concentrations of contamination. It usually applies to a site at which some type of contamination or pollution moves in from a nearby property. Statewide Health is derived from specific levels of chemical concentrations, based on acceptable cancer, and other health risks. Site-Specific allows the remediator to consider

exposure and risk factors to establish cleanup levels appropriate for the intended future use of the site. To qualify for Special Industrial Area, a site must either have no responsible owner or be in an enterprise zone. Whoever happens to be conducting the cleanup must not have contributed to the site contamination and must develop a cleanup plan. Further, cleanup actions must address all immediate, direct, or imminent threats, based on what the site will be used for. These four cleanup standards will be captured by three dummy variables.

It is important to remember that brownfield remediation and redevelopment is an endeavor from which firms are trying to earn a profit. (Occasionally some government entity will remediate and redevelop brownfields for its own use. However, for the sake of this analysis, we will assume that private firms will be the ones ultimately using the redeveloped site.) As a result of this, one may be initially inclined to say that the total cost of cleanup and future expected revenue streams are the only variables that truly matter, when determining whether or not a brownfield will be refurbished. While these two variables are certainly the bottom line, so to speak, there are a number of other variables that eventually bring about this bottom line. Hopefully, this study will serve to indicate the way in which the above variables affect remediation and redevelopment.

III. Model Description

I have constructed a probit model in which the dependent variable is whether or not a brownfield has been remediated (remediation corresponding to "1" and no remediation corresponding to "0"). The data set being used is composed of 120 sites, all from Bucks County, Pennsylvania. The data was provided by the Pennsylvania Department of Environmental Protection, or, more specifically, Pennsylvania's Land

Recycling Program. Because the data includes only those sites for which owners have filed an intent to remediate, the analysis measures the probability of remediation given that an intent to remediate has been filed. Thus, there are presumably many brownfields that, despite being in need of remediation and redevelopment, have not been registered with the Land Recycling Program as such. Why some brownfields have not yet been filed while others already have been, is an interesting issue, but one that we cannot provide any insight into, with the data here.

The independent variables are median income for the municipality in which the site is located, median house value for the municipality in which the site is located, type of brownfield, and time elapsed since the site initially was filed as having given an intent to remediate. Data on house values and median income is from the 1990 census. Because the dependent variable measures remediation given that an application was filed, time since filing is likely to predict remediation.

Due to the high degree of correlation between median income and median house value, two separate probit analyses were run, each one eliminating either median income or median house value.

IV. Results

For the first probit analysis, median house values were discarded and the following results were obtained:

TABLE 1

Parameter Estimates and Chi-Square Values

Intercept	5.873 (0.00)
Income (in thousands)	.01687 (.9166)
Time	.104 (1.2073)
Site Specific	-6.400 (0.00)
Statewide Health	-6.219 (0.00)
Background	-6.588 (0.00)

Because all of these estimates are statistically insignificant, their sign and magnitude are likewise insignificant. Thus, there is not a great deal to be said about these results.

TABLE 2

Parameter Estimates and Chi-Square Values

Intercept	5.902 (0.00)
House (in thousands)	.00529 (1.99)
Time	.105 (1.23)
Site Specific	-6.398 (0.00)
Statewide Health	-6.265 (0.00)
Background	-6.629 (0.00)

This analysis, which did away with median income, performed only marginally better. House, denoting median house value, is nearly significant with a chi-square value at 1.99. Thus, we can say that all other things being held constant, specifically the type of brownfield and the effects of time, a brownfield being in a municipality with high median

house values has a slight effect on whether or not a site is remediated given that an intent to remediate has been filed. This result is more or less what was expected. For any number of reasons then, a site being in a more affluent area, seems to enhance its probability of getting remediated given that an intent to remediate has been filed.

VI. Conclusions

Though this model has essentially failed to generate the results that were hoped for, there are certainly still some things that this model has shown us. First, high median house values, all other things being equal, seem to help a site's chances of being remediated. Though it is difficult to pin down the exact reason for this effect, it seems more than likely that it is because higher underlying land values make it easier to justify the cost of remediation. The articles of Singer (2001) and Yount (1997) both support this idea. Secondly and perhaps more importantly, this model has shown us that brownfield remediation is even more complex than we had conjectured. This model shows that if a statistical analysis is to be run on brownfield remediation, it needs to use variables other than the ones above, however hard or costly obtaining such data may be. Despite the general ineffectiveness of my study, I am in some way pleased that I have, at the very least, shown that some variables are *not* particularly important for redevelopment, given that an intent to remediate has been filed. Moreover, I am confident that progress in understanding the determinants of remediation will proceed, if data on all brownfields in a particular area, regardless of whether an intent to remediate has been filed, can be obtained.

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