The Private Market for Brownfield Properties

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Abstract

This study examines land sales over a 10-year period—1990 to 2000—in one southwest Baltimore industrial district—Carroll Camden—to determine the effect of land contamination on property sales and sales price. I tracked all sales, selling price, time on the market, and the presence of land contamination in the 5,580-acre area. The results indicate that after the mid-1990s, contaminated parcels sold on the private market, with price discounts that accounted for contamination and cleanup. Out of the 144 parcels sold over the 1990-to-2000 decade, positive and market-clearing prices were found for 45 parcels with either confirmed or historical-reasons-to-suspect contamination. Interviews with owners and brokers of parcels on the market for 2 years or more and analysis of the data indicate that the contaminated parcels that did not sell within the 2-year period (1) had above-market asking price; (2) were small and odd-shaped; (3) had inadequate road access for modern trucks; (4) had outdated water, sewer, and telecommunications connections; or (5) had incompatible surrounding land uses. Two policy implications result from these findings. First, if a city such as Baltimore wants to revitalize an industrial area—maintaining its industrial function and remediating contamination—government-subsidized cleanups may not be the most cost-effective policy. Rather, the city should (1) modernize the outdated infrastructure, including roads and fiber optic connections; (2) remove the outdated residential structures that sit in the midst of the industrial area and diminish the desirability of some land parcels for industrial use; (3) consolidate small and odd-shaped properties that are not conducive to modern manufacturing, warehousing, or other industrial uses; (4) ensure city services are efficiently provided, including trash cleanup and police and fire protection; and (5) improve access and egress for modern trucking. The evidence from the Baltimore study indicates that the private sector will discount land prices and assume cleanup responsibilities. The second policy implication is that the market is capable of brownfield cleanup in some locations.

Introduction

As the concept of "smart growth"[1] and its promise of more livable cities catch the imagination of planners, policymakers, and developers, the redevelopment of inner-city brownfield sites becomes an even higher priority. To justify limiting development on greenfield sites, regions must find buildable land within existing city limits. Contamination—the legacy of nonexistent environmental laws[2] and our industrial past—is widely perceived to be a deterrent to central-city revitalization, especially in the industrial Northeast.[3] This study examines the impact of land contamination on the market for industrial property and the extent to which contamination is responsible for the economic decline of the Carroll Camden industrial district. I suspect the results in Baltimore can be transferable to other declining central city industrial areas in the United States.

The common wisdom has been that (1) environmental cleanup costs are so high relative to land values that the government has to step in and provide subsidies for cleanup and redevelopment, (2) banks' refusal to finance such transactions undermines market demand, and (3) the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) legislation, which requires landowners to assume the responsibility for cleanup, and a lack of information about the risks and costs of contamination have lead to a lack of demand for contaminated land (Bartsch, 1996; Bartsch and Collaton, 1996). These conditions are seen as particularly harmful to central-city industrial land markets, where demand for land is already weak. This article considers whether contamination deters central-city revitalization, and to what degree factors other than contamination are an impediment to central-city redevelopment. This study tracks in one Baltimore industrial district all land sales, selling prices, lengths of time on the market, and presence of contamination. This methodology allows this study to document the degree to which sales were restricted to the area's clean parcels and to identify factors—including contamination—that are responsible for what is perceived as a relatively sluggish central-city industrial land market.

The results indicate that, since the mid-1990s, contaminated parcels in the Carroll Camden industrial district have been selling, and the market has adjusted to contamination by lowering prices. In fact, contamination does not appear to be the main sales barrier when the intended land use is industrial. To seriously implement smart growth and to encourage central-city industrial redevelopment, advocates and city officials must tackle the often ignored problems of older industrial areas—problems such as outdated parcel sizes, inadequate roads for modern truck access, outdated and aging infrastructure, incompatible land uses, and unrealistic assumptions about the land's possibilities.

[1] Smart growth is an urban planning concept whereby growth is concentrated in the center of a city to avoid urban sprawl and the mass consumption of open space and agricultural land.

[2] The federal government passed the Resource Conservation and Recovery Act in 1976 and the Comprehensive Environmental Response, Compensation, and Liability Act in 1980.

[3] The common argument has been that Superfund rules deter owners from selling their sites, securing financing for cleanup, or proceeding with reuse. See, for example, Bartsch (1996).

Literature Review

Three parts of the growing brownfield literature are especially relevant here: (1) the literature exploring the reasons contamination presents a barrier to the redevelopment of urban land, (2) studies examining where inner-city property redevelopment occurs in spite of contamination, and (3) the literature attempting to place contamination in context with other barriers to redevelopment. In all three literatures, case studies constitute the most common methodology. The contamination-as-a-barrier literature focuses on the role of cleanup costs, the fear of unknown and unpredictable future liability, the difficulty of obtaining private financing, and the legal costs associated with purchase agreements and collection of damages from other legally liable parties (Bartsch, 1996; Bartsch and Collaton, 1996; De Sousa, 2001, 2000; EPA, 2002, 1997; Green Leigh, 1994; Staley, 1996; Wright, 1997; Yount, 1997; Yount and Meyer, 1994). CERCLA made owners responsible for cleanup even if they did not cause the contamination. This legal liability could translate into immediate cleanup costs, legal costs associated with pursuing culpable parties, and uncertainty over future cleanup expenditures. These costs and risks are widely believed to be major deterrents to the sale and redevelopment of brownfields. Moreover, because lenders have, at times, been held liable for contamination cleanup costs, financial institutions are reluctant to lend for brownfield projects, which further reduces interest in redevelopment. A study by the U.S. Department of Housing and Urban Development (HUD), *The Effects of Environmental Hazards and Regulation on Urban Redevelopment* (1997), analyzed 48 redevelopment projects in 12 cities in 4 states. The study concluded that, although all the previously mentioned barriers exist, immediate cleanup costs are the main deterrent to inner-city redevelopment.

Despite extensive literature focusing on the costs, risks, liabilities, and barriers to redeveloping a contaminated site, several decades of successful cleanups and redevelopment projects indicate the existence of conditions in which some developers find it profitable to absorb the risks of purchasing, cleaning, and reusing contaminated parcels (Pepper, 1997; Simons, 1998). Many successful redevelopments required government subsidy, but not all. Meyer and Lyons (2000) documented the emergence of entrepreneurial firms redeveloping brownfield sites without public sector intervention. They found that these private ventures favored sites in high-value locations, under private ownership, and with larger parcels. This literature does not identify market-clearing prices for contaminated land, nor does it put contamination in perspective with other conditions that may be deterrents to development.

Three studies examined the price discounts associated with contamination. Page and Rabinowitz (1993) found land price reductions of 10 to 50 percent on four industrial projects spanning three states. McGrath (1995) found that redevelopment occurred on polluted sites and "discounts in land value due to contamination risk...consistent with the limited cost data available.... The industrial land market is highly competitive in the City of Chicago...and it appears that the market has successfully valued and capitalized the contamination liability" (McGrath, 1995: 18). Howland (2000) tracked all parcels in the Canton industrial area of Baltimore over a 2.5-year period as in use or idle and as on the market, sold, or for sale. She found that less than 5 percent of the land was idle and not on the market. This finding contradicts the notion that landowners would rather let land sit idle than tackle the cleanup costs and challenges. She found that, when contaminated

parcels were discounted, they were as likely to sell as parcels where no evidence or history of contamination existed.[4]

Other recent studies have begun to put contamination in context with other central-city redevelopment barriers. The 1997 HUD study concluded that contamination alone was rarely the deal breaker. Greenberg et al. (2000) identified barriers to redevelopment other than brownfields, including state and local regulations, unsafe neighborhood conditions (that is, crime and stray animals), industrial decline, more attractive adjacent areas, lack of schools, and poor transportation access.

This study's contribution comes from its focus on all sales in one industrial area over a 10-year period. These sold and for-sale parcels included both contaminated and clean sites. Much of the previous literature used the case study approach. Despite being rich in detail, the case study approach misses important lessons that can be learned from a broader study that includes all parcels, contaminated and clean, in one industrial district. First, the case study approach does not put the price of a contaminated land parcel in context with the whole neighborhood land market. (For example, rather than blaming poor market demand and high cleanup costs, perhaps the real sales barrier is created by the seller asking a price that is too high in light of market demand and cleanup costs. This information can only be garnered by studying sales in one market.) Second, by focusing on the redevelopment of high-profile, often problematic parcels, researchers miss the private redevelopment of numerous low-profile, contaminated parcels.

This study fills a gap in the literature by investigating all industrial parcels in one district and tracking their sales and prices over a decade. This study determines that the extent to which sales were limited to clean parcels, the price discounts associated with contaminated parcels that sold, and the characteristics of parcels, both clean and contaminated, that languished on the market for long periods or did not sell at all. In addition to tracking all sales over the decade, I interviewed REALTORS®, city officials, land purchasers, and land sellers. Through these interviews, I identified parcels withdrawn from the market without sale, idle parcels not on the market, new uses for sold property, and barriers to sale. With the exception of parcels used for stadium parking and a union office building, transferred parcels were used for industrial, construction, and warehouse purposes.

Overview of Area and Early History

Industry was originally attracted to the Carroll Camden district of Baltimore because of the availability of water power from the Jones Falls, its location near a port, the presence of rail lines, and its proximity to the city's downtown area.[5] Heavy industry can be traced to the 1890s. Sanborn maps

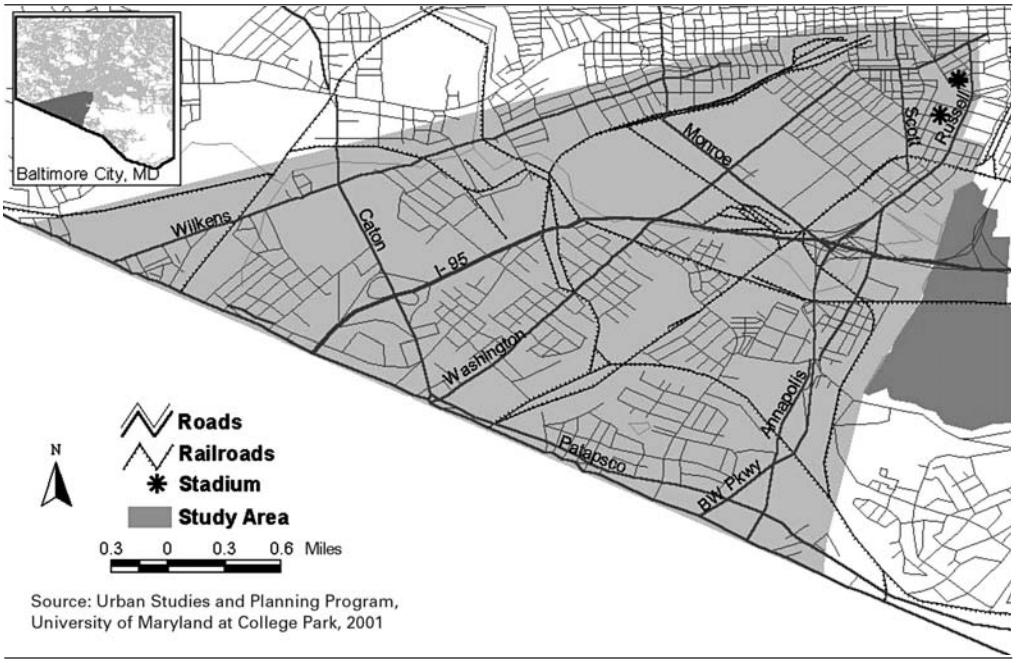
[4] The previous study by Howland (2000) surveyed all property owners in the Canton Industrial area over a 2.5-year period. That study, therefore, could identify the time a parcel was on the market before sale and cases in which parcels were put on the market and then withdrawn without a sale during this period. This study included only three categories of contamination: clean, contaminated, and unknown. In the current study, the time-on-the-market is missing for many sales early in the 1990–2000 decade because the sellers are inaccessible, real estate brokers do not recall, and purchasers often do not know how long the property was on the market. Time-on-the-market and parcels that went on the market and were withdrawn later in the decade were captured through broker interviews. The current study includes five categories of contamination.

[5] The area, which is adjacent to the Baltimore and Ohio Railroad Station (now a museum), was one of the earliest sites in the United States accessible to train transportation.

indicate the presence of glassworks, metal foundries and ironworks, brickworks, engine shops, meat slaughter and packing houses, lumberyards, paint and varnish manufacturers, household products manufacturers, and scrap metal yards. The study area included about 5,580 acres, comprising 740 industrial parcels (see exhibit 1).

Exhibit 1

Study Area for the Camden Carroll Industrial District: Camden Carroll Study Area



Sources of Data

The data for this study were pulled from the Baltimore Department of Public Works (DPW), the Maryland Department of Assessment and Taxation (DAT), CoStar, MacKenzie Commercial Real Estate Services, the Environmental Protection Agency (EPA), the Maryland Department of the Environment (MDE), and Sanborn Fire Insurance Maps. Each of these data sets and their purpose are discussed here.

Identifying Sales Transactions

The base map for the Carroll Camden industrial district was created from the Baltimore DPW parcel point file. The geographic information system coverage of this file records parcels by address and block lots and includes information on the current owner, zoning category, land use, last sale transaction back to 1988, and sale price. The study includes only central business district parcels that are zoned and used commercially and industrially. These parcels include zoned business dis-

trict commercial categories B-3, B-4, and B-5, and all industrial M categories.[8] The study excludes sites zoned residential, which are remnants of the time when industrial workers walked to work.

I obtained real estate transaction data from five sources. First, I extracted 1990-to-2000 sales data from the Baltimore DPW property tax records. These data were supplemented and cross-checked with information from the Baltimore Development Corporation (BDC); the DAT; CoStar, a privately maintained REALTOR® database; and MacKenzie Commercial Real Estate Services, a commercial real estate broker. Whereas DPW and DAT data sources contained information on properties that sold, CoStar contained information on commercial parcels currently for sale through real estate brokers. CoStar records provided contact information, asking prices, descriptive data of unique features, and previous sales information for sites that are on the market. BDC provided information on a few parcels for sale by owners. MacKenzie Commercial Real Estate Services added information regarding the amount of time a parcel remained on the market before sale. Where data were missing, the MacKenzie data were supplemented with time-on-the-market information obtained through personal interviews and phone calls to sellers and brokers. Time-on-the-market data, however, are still missing for 110 of the 144 sales.

From these sources, I created a data set of all industrial parcels in the study area, including those never on the market after 1990, those currently for sale, and those that sold between 1990 and November 2000. I geocoded owner, address, sale price, date of sale, sale history, time on the market of last sale, acreage, unique features, improved or unimproved status, and accessibility to the highway. I found 740 identified industrial records within the boundaries, as shown in exhibit 1. Of those, 161 went on the market from 1990 to 2000. This number included sales through brokers and by owners. Aside from the Koppers site, which the city is attempting to transfer to residential use, no parcels in this district were totally idle and not on the market (Escalante, 2002).

Collecting Environmental Information

To measure environmental conditions on each of the industrial properties, I looked to three sources: the EPA, the Sanborn Fire Insurance Atlases, and the MDE. I collected substantial qualitative information on environmental conditions at each site and developed a broad ranking system for the potential contamination level. The categories in the ranking system indicated if the site (1) was clean or provided no reason to suspect contamination, (2) was adjacent to a contaminated parcel, (3) had a historical use consistent with contamination, (4) was confirmed as having contamination, or (5) was processed through the Maryland Voluntary Cleanup Program (VCP),[7] which was initiated in 1997.

I looked for evidence of contamination in Carroll Camden on EPA's National Priorities List of Superfund sites and MDE's brownfield site inventory, and I identified contaminated sites in the area by pulling all contaminated properties that fell within the ZIP Codes overlapping the study

[6] B-3 and B-4 are defined as central business district commercial. B-5 includes marine terminals, railway rights-of-way, and a science center. M-1, M-2, and M-3 are all manufacturing districts. I excluded all residential and neighborhood business district categories of B-1 and B-2.

[7] State of Maryland, S. 340. 1997. Brownfields-Voluntary Cleanup and Revitalization Program.

area.[8] MDE records parcels where toxic spills and releases have occurred, neighborhood complaints of contamination have been recorded, and sites have been processed through VCP. Freedom of Information Act requests were filed with MDE for all properties sold and for sale. The typical contamination included asbestos, heavy metals, polychlorinated biphenyls, cadmium, lead, polycyclic aromatic hydrocarbons, heavy oils, and leaking underground chemical and oil storage tanks. These sources confirmed contamination on 21 of the 144 parcels in the study area that sold during the decade. Although many of these sites have been subsequently remediated, this article records their condition at the time of the sale. No sites in the Carroll Camden industrial district are contaminated enough to be on the Superfund list.

The Sanborn Fire Insurance Atlases were the primary sources used to identify parcels with a historical use that implies likely contamination. I reviewed the atlases for southwest Baltimore for 1890, 1915, 1951, and 1953 to garner information regarding original site boundaries, historical activities on each parcel, and the layout of activities within each site. I relied on the Sanborn atlases because frequently a connection exists between the level and type of contamination and the kind of manufacturing activity. Parcels historically used for steel and aluminum milling, chemical production, paint and varnish manufacturing, metal foundries and plating, glassworks, coal bins, rubber cement milling, printing, engine shops, or fuel oil and crude storage before 1953 were classified as having historical reasons to suspect contamination. Of the 144 sites sold, 23 had historical uses that would suggest contamination. Exhibit 2 indicates the historical use and contaminants consistent with those pre-1953 manufacturing activities.

Exhibit 2

Historical Land Uses in the Carroll Camden Industrial District and Associated Contaminants

Source of Contaminant	Contaminant
Paint and varnish manufacturers	Mercury, polychlorinated biphenyls (PCBs), arsenic, beryllium, cadmium, chromium, lead
Engine shops	Ethylene glycol, trichloroethane, trichloroethyene, PCBs, arsenic, beryllium, cadmium, chromium, lead
Metal foundries, ironworks, steel and iron foundries	PCBs, arsenic, beryllium, cadmium, chromium, lead, mercury
Glassworks	PCBs, arsenic, beryllium, cadmium, chromium, lead, mercury
Brickworks	PCBs, arsenic, beryllium
Coal plant	Benzene, trichloroethane, tetrachloroethane, coke, ammonia, tars and sludge, toluene, naphthalene, anthracene, phenols, ash, clinkers, heavy tars, sludge, lime sludge, spent iron oxides
Lumberyards	PCBs, arsenic, beryllium, cadmium, chromium, lead
Household product manufacturers	PCBs, arsenic, beryllium, cadmium, chromium, lead, mercury
Chemical product manufacturers	Benzene, ethyl benzene, toluene, xylene
Rubber cement milling	Benzene, toluene, xylene, PCBs, chromium

Source: EPA (2002)

[8] The Superfund parcels are listed online at http://www.epa.gov/superfund/sites/npl/. I obtained the properties on MDE data directly from the agency. The ZIP Codes are 21075, 21201, 21211, 21216, 21217, 21223, 21225, 21227, 21228, 21229, 21230, and 21234.

Results

Between March 2, 1990, and November 2, 2000, 161 properties, covering 379 acres, went on the market. Of those properties, 144 sold, with 18 selling at least once during the decade and reentering the market.[9] At least one parcel was listed for sale and then pulled off the market when it did not sell. As of November 2, 2000, 16 parcels were on the market. Most market activity occurred in the last years of the decade. Exhibit 3 shows breakdowns by level of contamination and year of sale.

Although clean sites constituted the largest share of sales, 15 percent of the sales were parcels that had confirmed contamination at the time of the sale. Two parcels went through the VCP; one was cleaned before it sold, and the second was cleaned and cleared through the program after the sale. The concentration of sales in the latter part of the decade is consistent with the increasing sophistication of remediation techniques, the increasing comfort of lenders in assessing risks, the developing environmental insurance options, and the growing certainty on the part of government about cleanup standards (see, for example, HUD, 1999; Meyers and Lyons, 2000; and EPA, 2002).

Exhibit 4 reports the effect of contamination on the price per acre of all sold parcels. The dependent variable is the real sale price per acre adjusted to 1982 dollars. The independent variables are—

- Adjacent—a dummy variable if the parcel is adjacent to one that has historical contamination or is known to be contaminated.
- Historical—a dummy variable if the parcel has a previous use that likely generated contamination.
- Contaminated—a dummy variable if the parcel is known to be contaminated at the time of sale.
- One turn—a dummy variable if the parcel is one turn off the main highway, where the main highway is the route leading directly to Interstate 95 (I-95).
- Two turns—a dummy variable if the parcel is two turns off the main highway.
- Three turns—a dummy variable if the parcel is three turns off the main highway.
- Area—the size of the parcel in acres.
- Yr_sold—the year the parcel sold.
- Improvements—a dummy variable indicating whether the parcel includes improvements, primarily buildings.

Exhibit 3

Number of Sales by Category of Contamination

	1990–1993	1994–1996	1997–2000	Total Number of Sales	Percent of All Sales
No evident contamination	5	13	54	72	50
Adjacent to contaminated property	1	6	21	28	19
Historical use suggests contamination	4	2	17	23	16
Confirmed contamination	1	2	18	21	15
Total	11	23	110	144	100

[9] Only the final sale is captured in this analysis.

Exhibit 4

OLS Results for All Sold Parcels—Dependent Variable Is the Real Price per Acre

	Model I	Model II
Intercept	– 170,733,190*	– 171,472,458*
	77,848,482	79,524,768
	[– 2.19]	[– 2.16]
Adjacent	– 353,978	– 359,656
	249,609	253,373
	[– 1.42]	[– 1.42]
Historical	– 543,848*	– 539,268*
	264,550	269,537
	[– 2.06]	[– 2.00]
Contaminated	– 559,762**	– 594,959**
	309,517	324,613
	[– 1.81]	[– 1.83]
One turn	– 530,875*	– 531,044*
	216,667	219,329
	[– 2.45]	[– 2.42]
Two turns	135,904	150,785
	293,248	303,346
	[.46]	[.50]
Three turns	– 776,536**	– 864,007**
	443,710	484,558
	[– 1.75]	[– 1.75]
Area	– 35,286	– 33.621
	22,521	23,728
	[– 1.57]	[– 1.42]
Yr_sold	86,059*	86,436*
	38,968	39,790
	[2.21]	[2.17]
Improvements	—	– 14,699
	—	301,099
	—	[– .05]
N	133	131
R^2	.16	.17
Adj R^2	.11	.10

OLS = ordinary least square.

** Statistically < .05. ** Statistically < .10.*

In addition to including the contamination variables, I included location dummies to control for the expected drop in price for sites farther from a main highway. Size is included because other studies have found a price-per-acre premium for larger sites (Howland, 2000; Meyer and Lyons, 2000). Yr_sold is included to capture both the reductions in uncertainty and falling costs of remediation throughout the decade as well as the increase in land values on contaminated sites. In addition, Yr_sold captures the state of the broader economy and expectations about future appreciation. The presence of improvements was included to control for the effect of a building on price. I also tested enclosed square footage, but it was not statistically significant; therefore, I dropped it from the final equation.

Potential missing variables that might permit a full hedonic model would include factors such as the shape of the parcel, the slope of the parcel, activities on the road to the parcel (that is, residential units that reduce the value of land for industrial uses), activities surrounding the parcel (again, residential units that depress the value for industrial uses), finer details on the size and quality of roads, specifics on the quality of access to I-95, a more refined contamination variable (that is, the precise cleanup costs), and existence of seller financing. No theoretical reason exists, however, to suspect that these variables are correlated with the contamination categories; therefore, their exclusion does not bias the coefficients on the contamination variables. I attempted to collect time-on-market data, but, because I collected this information from sellers, buyers, or realtors, it was impossible to obtain data for all but 34 of the parcels sold. These 34 were sold in the latter part of the decade. An abbreviated run that included "time-on-market" data added nothing to the model's explanatory power.

After holding transportation access, size of parcel, and the year sold constant, the presence of contamination reduced the sale price. The coefficients on the historical-reason-to-suspect and known-to-be-contaminated variables were significant at the 5- and 10-percent levels, respectively. A clean site on the main road sold for an average of $836,000 per acre. A parcel adjacent to a contaminated site (that is, a site with either known contamination or historical reasons to suspect contamination) was discounted 42 percent. A site with historical reasons to suspect contamination was discounted an average of 65 percent, and a site with known contamination was discounted an average of 67 percent.[10] The fact that discounts were similar on suspected-to-be-contaminated-for-historical-reason and known-to-be-contaminated sites suggests that my method of identifying contamination by examining historical use is a good measure of contamination and that cleanup costs for the two categories are nearly equivalent. These discounts probably reflect (1) remediation costs, (2) the fact that the market for contaminated properties is more limited because the purchasers are restricted to those with their own nonbank sources of credit, (3) delays associated with testing and assessing the costs of remediation, (4) costs and delays associated with cleanup before the property can be put to productive use, and (5) any additional risk associated with owning a polluted parcel.

As expected, parcels located off the main highway sold at a discount. Parcels located one turn off the main highway accessible to I-95 sold for an average of $530,000 less per acre than parcels on the main highway. The coefficient on two turns off the main highway was not statistically different from the price on the main highway, but parcels located three turns off the main highway to I-95 sold for an average of $776,536 less per acre than parcels on the main highway.

The year the property sold, Yr_sold, was positively associated with the sale price. More recent sale prices have been higher. The price increases could reflect the private sector's growing experience in dealing with contaminated properties, the falling prices of cleanup technologies, the improving national economy during that decade, or revitalization efforts initiated by BDC. It is not surprising that neither the presence of improvements nor the square footage of enclosed space[11] was statistically

[10] Several reviewers asked why this study did not include a more precise measure of the seriousness of contamination. It is difficult, for example, to compare a more serious contaminant concentrated in one portion of the site with a less toxic pollutant spread evenly across the site. Data on actual cleanup costs proved impossible to collect directly from landowners.

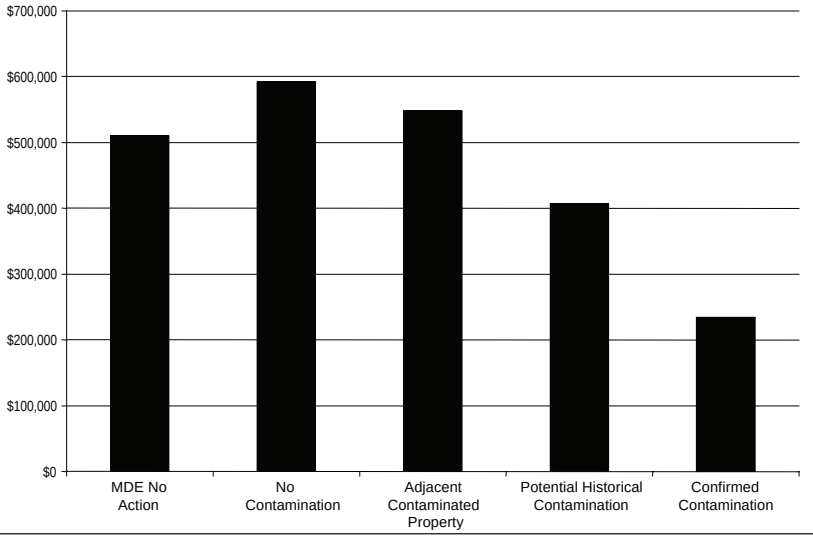
[11] Not reported here.

significant, because improvements could represent either a usable structure or a costly demolition. The average sales price for the 144 parcels sold between 1990 and November 2000 is shown in exhibit 5.

Both models that include and exclude onsite improvements in exhibit 4 report relatively low R^2s,[12] which is not atypical for cross-sectional data that have a lot of random disturbance (see, for example, Kmenta, 1971). Low R^2s do not reflect the correctness of the model or the test of the hypothesis that contamination influences selling price, unless omitted variables are correlated with the contamination variables, and no evidence of such correlation exists.

Exhibit 5

Average Sales Price, November 1990–2000



MDE = Maryland Department of the Environment.

Barriers to Sale and Redevelopment

Examining parcels that languished for long periods on the market and those that sold quickly can shed some light on the barriers to industrial land sales. Exhibit 6 compares the parcels that took more than 2 years to sell with parcels that sold within 1 year. Once again, contamination does not appear to be the main sales deterrent. The quick sellers had just as high of a probability of being contaminated as the languishers. The striking feature of this comparison is that quick sellers had an average per acre price of $314,000, as opposed to the sale price of $826,000 per acre for parcels that took 2 or more years to sell. Parcels that were on the market for more than 2 years as of November 2000 had an average asking price of $798,000 per acre. One barrier to sales appears

[12] R^2s report the proportion of variability explained by the model's independent variables.

Exhibit 6

Characteristics of Parcels on the Market More Than 2 Years and Less Than 1 Year

	Number of Parcels	Asking/Sales Price Per Acre ($)	Size in Acres	Extent of Contamination, % of Parcels	Average Time on the Market
Languishers (more than 2 years)					
For sale	8	798,319	2.9	.25 clean .25 adjacent .50 historical	3.4 years
Sold	10	825,937	2.7	.20 clean .20 adjacent .40 historical .20 contaminated	3.4 years
Quick sellers (less than 1 year)					
Sold	16	312,138	1.8	.37 clean .06 adjacent .31 historical .25 contaminated	0.8 years

to be that some sellers overvalue their property.[13] Similarly, Howland (2000) found price to be a statistically significant determinant of time on the market for both contaminated and clean sites in southeast Baltimore.

Large parcels do not ensure a quick sale. In the Carroll Camden industrial district, the quick-selling parcels were, on average, smaller than the parcels of the languishers. In older industrial areas, a parcel containing improvements is often at an advantage because obsolete buildings have to be removed before redevelopment can occur. But little difference exists in the proportion of improved parcels between the quick sellers and the languishers. In fact, little unimproved land in the Carroll Camden district exists at all. The area's long industrial history has left behind extensive and often substantial structures.

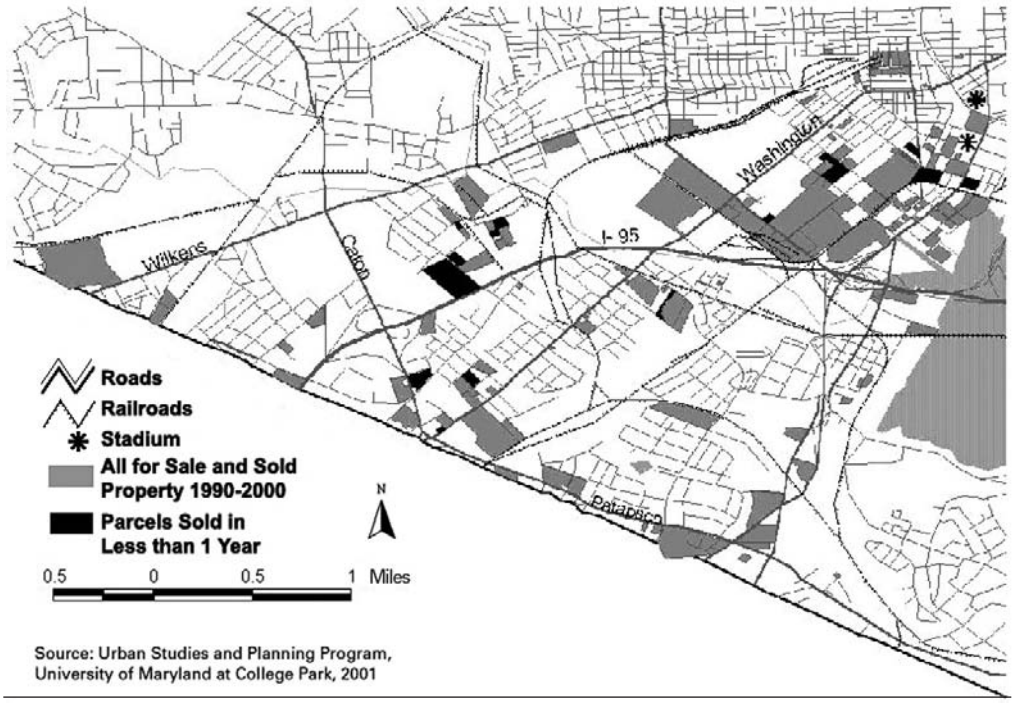
The comparison shows no indication that quick sellers and languishers are concentrated in specific locations. Exhibit 7, the quick sellers, and exhibit 8, the languishers, illustrate that both groups are spread over the whole industrial area.

These results reflect that, for the time being, this industrial district is remaining industrial. Because the state does not require cleanup standards for industrial use that are as strict as for residential use, cleanup costs are lower in the Carroll Camden district than they would be in an area converting to nonindustrial use. Sites converting from industrial use to residential or commercial use face higher cleanup costs and, therefore, lower and possibly negative property values. Many of the brownfield case studies reported in the literature address property being converted from industrial

[13] Real estate agents in the area say that some sellers are holding out for unrealistically high prices, hoping for the same high figures paid by the Maryland Stadium Authority for the land under Camden Yards, or they are waiting for spinoffs from the stadium. One owner of a large contaminated parcel that has been on and off the market for years said, "I have plenty of money and am in no hurry to sell."

Exhibit 7

Parcels Sold in Less Than 1 Year



to residential or commercial use. This fact may explain their argument for the need for government intervention and subsidies. Contaminated parcels being converted to residential use require more stringent and expensive cleanup than parcels remaining in industry, pressing property values lower, thereby requiring government intervention and subsidy.

Other Barriers to Resale

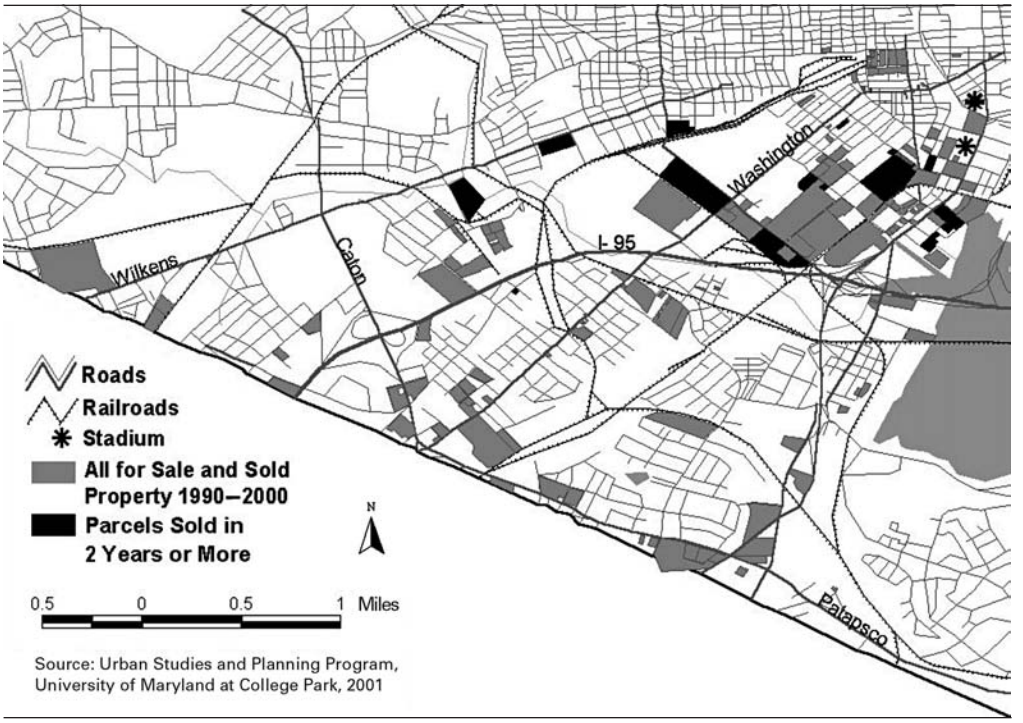
I conducted a series of extended interviews to determine which factors are barriers to property sale and industrial redevelopment. I interviewed the real estate agents or property owners of every parcel that had been on the market for 2 years or more or that was on the market and withdrawn without sale. In addition, I conducted four in-person interviews with private firms that purchased or sold contaminated parcels. In all cases, the land purchasers were using the property for their own businesses.[14] I interviewed city officials to identify parcels that were idle and not on the market[15] and conducted site visits for every parcel sold and for sale. The interviews and site visits

[14] Most purchasers had their own financing.

[15] I interviewed local real estate brokers Chuck Franklin, Robert Milhauser, Kate McDonald, David Tufaro, and Bill Miller, and Evans Paul and Richard Escalante of BDC. I conducted telephone or in-person interviews with the sellers, purchasers, developers, or brokers for the 15 parcels that had been on the market for 2 years or more. I also visited each site. In addition, I interviewed purchasers or sellers of contaminated sites.

Exhibit 8

Parcels Sold in 2 Years or More



highlighted a number of barriers to sale and redevelopment, including small, odd-shaped sites; expense of removing obsolete structures; outdated road size and configurations; inadequate water, sewer, and telecommunications infrastructure; existing land uses incompatible with industry; and difficulty in changing the land use from industrial to residential because the private demand for market-rate housing is not strong enough to compensate developers for the costs of remediating contamination and constructing residential units.

As is typical of turn-of-the-20th-century industrial cities, Baltimore still has residential city blocks integrated with industrial-use blocks. Because they no longer provide walking access to work, these blocks have lost their desirability as residential locations. Land values are low, housing conditions poor, and vacancy rates high. Heavy truck traffic and dirty industrial activities (such as waste management) further depress the demand for housing in these areas. Heavy industry, of the type located in the Carroll Camden industrial district and many other turn-of-the-20th-century cities, is incompatible with residential activity. Industrial land sellers with land near residential units have difficulty selling because potential buyers fear their industrial vehicles will hit playing children, because residents object to heavy truck traffic in off hours, and because of actual or perceived high rates of theft and vandalism.

Lack of truck access also inhibits land sales, particularly in areas where the road width and pattern are incompatible with modern trucking requirements. The current street pattern was laid out for

residential use mixed with multistory, rail-oriented manufacturing and small-scale trucking. Rail dependence has declined, being displaced by container trucking. Without modern truck access, industrial parcels are difficult to sell.

Although many believe that an inner-city site's advantage stems from its ready access to infrastructure, a common grievance among property owners is that water, sewer, and telecommunications facilities are outdated and inadequate.[16] In the Carroll Camden industrial district, land sellers, recent purchasers, and operating businesses complained that water and sewer facilities needed to be updated and expanded and that modern telecommunications linkages are missing.

Several additional parcels that failed to sell contain obsolete buildings that are expensive to demolish. In one case, the obsolete building is a refrigerated storehouse that cannot be renovated or demolished without significant expense. In the final analysis, however, such properties are also languishing on the market because the sellers' asking prices are out of line with demolition costs and the properties' productive capacity.

Another barrier—cleanup costs—has arisen on a site that the city and a private developer are attempting to redevelop for housing. Despite city subsidies of nearly free land,[17] escalating cleanup costs have pushed projected final house prices well beyond what the market can bear in this section of downtown Baltimore.[18]

Conclusion

By tracking property sales in Baltimore's Carroll Camden industrial district, I have shown that brownfields have a market-clearing price. How do these results compare with the case studies cited in the literature, where redevelopment failed or required costly government subsidy? My results apply to cases in which contamination is serious but not at Superfund levels of pollution and where the parcel will remain industrial as opposed to converting to residential or commercial. In addition, the results apply to a well-located industrial area. Route I-95 is a major U.S. interstate highway that runs down the entire eastern seaboard and intersects the Carroll Camden industrial district. The conclusions drawn in this study would not necessarily apply to the many more isolated and inaccessible contaminated industrial districts in Baltimore.

In the Carroll Camden industrial district, contaminated parcels are selling without government intervention because sellers are lowering prices to compensate for contamination. From 1990 to 2000, parcels with known contamination sold at an average 67-percent discount, parcels with historical uses that give reasons to suspect contamination sold at an average 65-percent discount, and parcels adjacent to a contaminated site sold at an average 42-percent discount. Only 2 of the 144 sites entered and completed the Maryland VCP.

[16] High-speed Internet connections are not available at most sites.

[17] The city is selling the land for $15,000.

[18] For a full description of the site, see Howland. (2003).

This conclusion does not imply that federal, state, and local brownfield initiatives are ineffective or unnecessary. Many of the remediation techniques adopted by the private sector were initially tested as part of government-sponsored demonstrations. Moreover, in locations with weaker market demand, especially those areas with toxic and extensive contamination or those that will be changed to residential use, land values may fall into the negative range, in which case redevelopment will require government subsidy.

By emphasizing environmental contamination as the main obstacle, however, policymakers may have overlooked other deterrents to redeveloping industrial districts in the central city. In the Carroll Camden industrial district, these barriers include outdated road configurations that make truck access and egress difficult, antiquated infrastructure, inadequate telecommunication linkages, incompatible residential and industrial land uses, obsolete buildings that prove expensive to demolish, and sellers who are unwilling to lower prices. Fortunately, all but the last of these barriers are those over which policymakers and city government officials have control.

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