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Brownfields

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Guest Editor's Introduction

Edwin Stromberg
U.S. Department of Housing and Urban Development

It cannot be emphasized strongly enough that what follows is my own personal opinion, not the official position of the U.S. Department of Housing and Urban Development (HUD). It is, however, informed by many years as a HUD employee, working on urban redevelopment.

The standard definition of a brownfield, as embodied in the Small Business Liability Relief and Brownfields Revitalization Act, is a "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant."

Federal concern about brownfields arose as a direct consequence of growing criticism of and reaction to the get-tough "polluter-pay" federal policies contained in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, or "the Superfund law").[1] CERCLA, which Congress passed in reaction to the Love Canal environmental disaster, came down forcibly on any entity that caused or tolerated environmental pollution. The law imposed a severe liability scheme known as "strict, retroactive, and joint liability." Although modified and moderated in 1986 by amendments, CERCLA was initially characterized by environmental lawyers as imposing a wide net with harsh and unremitting sanctions.

Reaction to the law, particularly from the development community, was quite strong. Critics claimed that the Superfund law was draconian and that it was having a severe chilling effect on urban revitalization, particularly for older and more mature cities. Its provisions applied to any contaminated site, not just sites with CERCLA designation, which magnified the law's impact.

The Clinton administration developed strategies to respond to these criticisms. The Environmental Protection Agency (EPA) implemented an aggressive set of initiatives to counteract the view that, through its rigorous enforcement of the Superfund law, it was a major obstacle to urban revitalization. The EPA's Brownfield Pilot Grant program, which awarded 200,000 grants to localities to assess their own brownfield problems, was the most visible dimension of EPA's brownfield initiative.

Congress asked what is now the Government Accountability Office (GAO) to assess the extent of the problem in the country. Basing its analysis on very limited data resources, the GAO estimated that roughly 425,000 brownfields existed in the country. Speakers and authors have often used higher figures—450,000, 550,000, and even 650,000—citing GAO as the source. Today, among

[1] Some claim that the specific precipitating events were a few court cases that pulled lenders and investors into the CERCLA liability chain, which led to capital flight. Although this claim may be true, the Superfund law itself was the larger force at work.

the frequent references to 1 million brownfields, are mentions of sites such as gas stations, which were not originally part of EPA's definition of a brownfield.[2]

EPA's mission involves regulating contaminated land. Consequently, EPA's perspective has been site specific and tended to promote assessing and cleaning up specific contaminated sites as the driving forces behind urban revitalization and renewal. EPA commonly reported on the amount that its planning grants for small brownfields leveraged in urban investment or reinvestment, because the brownfield program was doing more urban redevelopment than just site cleanup and because no redevelopment would take place unless the initial cleanup dollars—even at small amounts—were invested.

Nonetheless, EPA's proactive approach quickly attracted the enthusiasm of and support from both the public and private development sectors. Because local governments were looking for federal leadership and assistance in overcoming the challenges of older urban areas and because grant funds for brownfields could be used for properties in attractive market areas, programs for EPA's brownfields were popular. Overall, EPA's brownfield initiatives have contributed substantially to urban revitalization: they have reenergized the field of urban revitalization; they have prompted the EPA to streamline its own regulatory approaches to brownfield investigation and cleanup; they have encouraged states and localities to streamline their own brownfield reclamation policies and to develop innovative approaches to reclaim blighted urban areas; and they have provided a welcome infusion of funds, training, and technical assistance for revitalizing declining and blighted urban communities.

The U.S. Department of Housing and Urban Development's (HUD's) perspective has been different from the start. HUD is an agency concerned with development and redevelopment; it is not an environmental regulator. HUD never viewed its mission from a "brownfields perspective," (that is, identifying and cleaning up specific sites as a significant engine of urban revitalization). Although HUD, along with all other federal agencies, is required to administer a wide array of environmental mandates, which are taken very seriously, such mandates represent only one aspect in the development process. To emphasize: brownfields was the mission, mandate, and message of EPA's approach to the contaminated properties of older urban areas. HUD has never considered brownfields its major focus.

Despite this differance, HUD funding might be the single greatest source of funding for brownfield revitalization because of the great flexibility with which communities can use community development block grants. The purpose of the Community Development Block Grant (CDBG) program has been to promote local discretion, not specific categorical requirements. The general philosophy has been to encourage and support broad, neighborhood, community-oriented improvement, with the priority being on helping low- and moderate-income families and communities. Unfortunately, HUD has never tracked to what degree it has supported brownfield revitalization, in part, because of a general policy of minimizing grantees' reporting burden and because HUD has no metric for measuring its effect on revitalizing brownfields.[3]

[2] The distinctions between EPA's views of brownfields and those of the Department of Housing and Urban Development are discussed later in this introduction.

[3] Until recently, the Federal Housing Administration's stringent site cleanup requirements have constrained its separate contribution to brownfields revitalization. See Eugene Goldfarb's article, "Field Survey of HUD Site Contamination Policy," in this symposium (Goldfarb, 2010).

The minor role that HUD played in the brownfield issue was also illustrated in the creation of the Brownfields Expensing Tax Incentive, a 1996 enactment that allows developers to deduct all brownfield cleanup costs the year they are incurred instead of amortizing them over many years. Primary responsibility for its management has resided with the U.S. Treasury.

The surging interest in the idea of brownfield redevelopment led the Clinton administration to ask Congress to create the Brownfields Economic Development Initiative (BEDI). Communities could use BEDI funds only if the sites met EPA's definition of brownfields and EPA's regulatory requirements. The BEDI program was quite small—$25 million in annual appropriations in the first few years of its existence—but may have been the high point in HUD's formal role in brownfields as a policy issue. HUD and EPA actively cooperated in the program's implementation.

With the transition to a new administration, however, HUD's role in the brownfield issue eroded quickly. The Bush administration sought to terminate the BEDI program, which Congress continued to fund, but at increasingly smaller levels. HUD policymakers stopped actively addressing the brownfield issue, leaving EPA to dominate brownfield policymaking. Although the BEDI program has continued, and has been HUD's only development program specifically addressing brownfield needs, at the local level, CDBG funds probably provided the bulk of federal funding devoted to brownfields. Because brownfields are frequently associated with slums and blight, which are an eligible use of CDBG funds, such linkage allowed for the use of CDBG for properties with significant market potential that were not located in low-income areas.

Between 2001 and 2008, HUD did not mount any major new community or economic development initiatives, so it has been quiescent in its brownfield-related efforts as well. The BEDI program continues, but, in the past 4 years, both administrations have recommended eliminating the program, deeming it duplicative of other federal community development efforts; it has so far survived because of support in Congress.

Although HUD and EPA moved along seemingly parallel program tracks in the 1990s, HUD, in fact, did mount an effort to work with EPA on brownfield issues and to conduct research on brownfields relevant to HUD's community revitalization mandates. This effort was the result of an interagency agreement between HUD and EPA, signed by HUD Secretary Henry Cisneros and EPA Administrator Carol Browner in 1996, which pledged mutual cooperation between the two agencies on brownfield issues. As a practical matter, there was too little cooperation in ensuing years, except for the staff cooperation on the BEDI program, HUD's participation in EPA's federal partners working group, and some scattered efforts in the field independent of headquarters oversight.

HUD's Office of Policy Development and Research (PD&R) has conducted a vigorous research program on the role of brownfields in urban decline and urban revitalization. PD&R has sponsored the following brownfield-related research: *The Effects of Environmental Hazards and Regulation on Urban Redevelopment*, a study of how brownfields and attendant liability and regulatory issues could be thwarting site cleanup and redevelopment; *Redeveloping Brownfields: How States and Localities Use CDBG Funds*, which documents how localities used CDBG and related programs for "brownfield" redevelopment; *An Assessment of State Brownfields Initiatives*, which reviews and assesses leading state activities to address brownfields redevelopment; *Environmental Insurance for Brownfields Redevelopment: A Feasibility Study*, which analyzes the feasibility of using environ-

mental insurance as a tool in brownfield redevelopment; *A Guide to Deconstruction: An Overview of Destruction With a Focus on Community Development Opportunities*, which shows how deconstruction could be used in community renewal; and *Study of HUD's Site Contamination Policies*, which focuses on Federal Housing Administration brownfield cleanup requirements for multifamily housing. Other significant PD&R actions, aside from the development of the HUD-EPA Interagency Agreement on brownfields, include a report on the identification and assessment of possible changes to CDBG regulations to make them more conducive to cleanup and redevelopment; public forums to examine policy options for brownfield redevelopment; a followup study of how HUD field offices implement these policies (the followup study is published in this issue); and a forum, with EPA participation, on how brownfields fit into the emerging sustainability agenda. All these studies can be accessed on www.huduser.org.

Although HUD and EPA were moving along parallel tracks for much of the past two decades, EPA's brownfield mission and HUD's revitalization mission now are moving closer together. EPA has recognized the need to promote broader scale renewal through its recently announced Area-wide Brownfields Assessment Grant program. EPA has also launched an urban waters revitalization initiative, which is intended to be a multipronged, interagency effort to promote revitalization with water resources as the hub.

The current administration now formulates HUD's basic mission in the following terms: "Create strong, sustainable, inclusive communities and quality, affordable homes for all." HUD has been given lead responsibility for the Partnership for Sustainable Communities (whose founding members are HUD, EPA, and the Department of Transportation [DOT]) through its stewardship of the Sustainable Communities Planning Grant Program and the Challenge Grant program. The underlying purpose of the Partnership for Sustainable Communities is to align housing, community development, transportation, environmental, and other federal resources and policies to support a sustainable future. The real challenge is to bring each agency's considerable resources, knowledge, and expertise into the Partnership for Sustainable Communities, as exemplified by the principles of sustainability and livability, the DOT's formulation of sustainability. This means moving beyond brownfields as a critical policy focus. The contamination of urban land remains a very real concern, so the tools and approaches developed to address brownfields are still essential and will be for a long time, but it is time for a broader conceptual perspective to govern federal urban policy.

In This Issue

In May 2008, Margherita Turvani of the Università IUAV di Venezia organized an "exploratory workshop" on brownfields for the European Science Foundation (ESF). In February 2009, she approached *Cityscape* with a proposal to publish the papers from the workshop as a symposium. We agreed that some of those papers would interest *Cityscape* readers, and we are grateful to Dr. Turvani for her assistance. As guest editor, I have worked with authors of selected papers from the ESF workshop and with authors of other papers that I was aware of to prepare this symposium, which consists of five original research articles. The articles, all thought provoking, represent varying perspectives and approaches to brownfield issues. Inasmuch as no third-party referees were involved, their inclusion is entirely my decision.

The first two articles are small-scale empirical studies of industrial brownfields in a particular eastern city. Dennis Guignet and Anna Alberini's study, "Voluntary Cleanup Programs and Redevelopment Potential: Lessons From Baltimore, Maryland," examines whether a state voluntary cleanup program can support redevelopment of contaminated properties in an urban industrial area and whether the program can serve as a possible alternative to the conversion of agricultural land and open space (that is, greenfields) in suburban and rural areas of the state.

The study by Marie Howland, "The Private Market for Brownfield Properties," is an empirical study of the effect of site contamination on sales and sales prices of properties in an industrial area of Baltimore. The study found that, after the mid-1990s, contaminated parcels sold on the private market, with price discounts accounting for contamination and cleanup. The author concluded that, although the private market can address the costs of site cleanup itself, public intervention is still needed to overcome the classic problems of obsolete, obsolescent, and fragmented land use and urban infrastructure.

Peter B. Meyer's article, "Brownfields, Risk-Based Corrective Action, and Local Communities," explores the seemingly irreconcilable conflict between economic development and environmental improvement. Meyer reviews some U.S. responses that avoid sacrificing environmental to economic gains and suggests lessons that states and municipalities may learn from others, after socioeconomic, political, and legal differences are taken into consideration.

Eugene Goldfarb's article, "Field Survey of HUD Site Contamination Policy," which is a followup to a *Study of HUD's Site Contamination Policy* (HUD, 2003), examines how HUD field offices administered the Department's (particularly the Federal Housing Administration's) official policy at the time (2003), which discouraged using the risk-based corrective approach to brownfield redevelopment. The article also has implications for the Department's urban mission.

Finally, David Slutzky and A.J. Frey's article, "Brownfields Uncertainty: A Proposal To Reform Superfund," reviews America's brownfield problem (that is, the barriers to brownfield redevelopment) from the perspective of the current environmental liability and financial support framework and offers a bold proposal to overcome existing impediments.

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Voluntary Cleanup Programs and Redevelopment Potential: Lessons From Baltimore, Maryland

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Abstract

In the United States, policy has increasingly shifted toward economic incentives and liability attenuation for promoting cleanup and redevelopment of contaminated sites, but little is known about the effectiveness of such policies. These policies include, among others, state Voluntary Cleanup Programs (VCPs), which were established in the United States in the 1990s and, to date, have been implemented in nearly every state. This article focuses on 116 Baltimore properties that were enrolled and participated in the Maryland VCP from its inception in 1997 to the end of 2006 and examines what type of properties tend to participate in these programs, how these properties compare with other eligible but nonparticipating sites, and what the redevelopment potential of VCP properties and implications is toward open-space conversion.

We find that most applicants (66 percent) actually requested a No Further Requirements Determination directly, rather than proposing cleanup. Nevertheless, the VCP led to the identification and environmental assessment of 1,175 acres of contaminated land in the city of Baltimore alone. In Baltimore, VCP properties tend to be industrial, located in areas zoned as industrial, and away from residential neighborhoods. In more recent years, larger properties have increasingly enrolled in the program. Most participating sites are reused as industrial or commercial properties. In contrast with Alberini (2007), these findings suggest that, in Baltimore, pressure for residential development has not driven VCP participation to date. Based on differences in zoning requirements, the VCP may reduce demand for potentially contaminating activities on pristine land by as much as 1,238 to 6,444 acres, in Baltimore alone.

Introduction and Motivation

Many observers believe that the liability regime imposed by federal and state hazardous waste programs in the United States is at least partially responsible for discouraging the purchase and reuse of contaminated or potentially contaminated sites, which have remained idle or underused.[1] The resulting "brownfields"—industrial sites whose expansion, redevelopment, or reuse "may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant" (EPA, 2007), to the point that public intervention may be needed (Alker, Roberts, and Smith, 2000)—cover thousands of acres in many urban and rural areas of the country (GAO, 1995).

A number of recently established state programs and new federal legislation aim to reverse these disincentives and stimulate the cleanup and productive reuse of brownfields. For example, in the 1990s, several states established Voluntary Cleanup Programs (VCPs) offering liability relief, other economic incentives such as tax credits or low-cost loans, oversight and expedited approval of cleanup plans, and simplified cleanup standards in exchange for site remediation (Bartsch and Dorfman, 2000; Meyer and VanLandingham, 2000).

Under the Federal Brownfield Tax Incentive, established in 1997, environmental cleanup costs for eligible properties are fully deductible in the year in which they are incurred, as long as the property is used for trade or business or for the production of income. Likewise, state brownfield programs offer tax credits or other benefits in exchange for cleanup and investment at potentially contaminated properties located in blighted areas.

Finally, the federal Small Business Liability Relief and Brownfield Revitalization Act of 2002 offers conditional relief from environmental liability for property owners and purchasers of land. This law also establishes the U.S. Environmental Protection Agency (EPA) Brownfields Program, which provides assessment and cleanup grants to state and local governments and communities and grants that states can use to establish revolving loan funds.

Little is known about the effectiveness of these economic incentives and liability attenuation policies in promoting cleanup and redevelopment. Questions remain about whether these programs effectively provide public funding to redevelopment projects that would have occurred anyway (Alberini, 2007), and concerns exist about unspent dedicated public funding (Schoenbaum, 2002). Common perceptions—that most brownfield properties are former industrial sites, are located in central cities, and bear riskier, less profitable redevelopment potential than equivalent projects on pristine lands and in suburban areas—have been challenged (De Sousa, 2000; Page and Berger, 2006). Deason, Sherk, and Carroll (2001) analyzed urban redevelopment projects and computed

[1] The Superfund program was established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), passed in 1980 and amended and reauthorized in 1986. It is probably the best known among the public programs addressing hazardous waste sites in the United States. Under the Superfund program, the U.S. Environmental Protection Agency (EPA) has the authority to identify contaminated sites needing remediation, track down the responsible parties, and force them to pay for cleanup (or reimburse the Agency for the cleanups it initiated). Liability for the cost of cleanup is retroactive, strict, and joint and several, with potentially responsible parties to be sought among the owners and operators of the site and the transporters of the wastes. Liability in some cases has been construed to apply to property owners and lenders that foreclose on contaminated properties (Fogleman, 1992).

the size of equivalent projects in open and suburban areas, showing that because of differences in zoning the latter often take up considerably more land than infill redevelopment, thus contributing to sprawl and erosion of open space.

A better understanding of what types of properties tend to be enrolled in VCPs is crucial in evaluating programs offering incentives and assistance for brownfield cleanup and redevelopment.[2] This article examines the VCP of Maryland and poses three related questions: (1) What types of properties tend to participate in the Maryland VCP? (2) How do these properties compare with other eligible but nonparticipating industrial and commercial properties? (3) What is the redevelopment potential of VCP parcels and can the VCP enroll enough acreage to be an alternative to the conversion of greenfields?

To answer the first two questions, the article examines the parcels enrolled in the VCP from its onset in 1997 to late December 2006. To ensure a relatively homogeneous legal and tax environment, attention is restricted to enrolled properties in the city of Baltimore.[3] The enrolled set of parcels is supplemented with a sample of comparably sized parcels drawn at random from the universe of industrial and commercial properties in the city of Baltimore, which are used as a "control" group. The newly formed sample—enrolled properties plus similar nonenrolled properties—enabled us to establish whether the VCP tends to attract parcels that are systematically different from other industrial and commercial properties in Baltimore.

During the study period, in response to questions (1) and (2), the VCP identified 1,175 acres of potentially contaminated land in Baltimore, most of which were not identified through other programs, and thus, before the VCP, were likely unknown to city and state regulators. Simple univariate analyses suggest that VCP properties in general are larger, less capital intensive, and have a higher probability of prior contamination than nonparticipating parcels. Probit regressions confirm that VCP enrollment and participation is more likely among industrial sites located in industrial areas and less likely at heavily built sites close to residential areas. Even more important, the probit regressions point to the changing nature of the program—or of the sites that tend to be attracted to the program. In the first few years of the VCP, smaller properties tended to be enrolled in the program. Most recently, however, enrollment has been more likely among larger properties.

To answer the third question, the article examines the restrictions imposed on the property when the state agency granted a No Further Requirements Determination (NFRD) or issued a Certificate of Completion (CoC). In most cases, residential uses are not allowed, some physical maintenance is required to avoid exposure to contaminants, and use of groundwater on the premises for drinking purposes is prohibited. There is very little evidence of changes in land use at enrolled sites, and enrolled properties tend to be located primarily away from residential areas. Taken together, these facts suggest that VCP sites will likely continue to be used in an industrial or commercial manner. These conclusions are in sharp contrast with Alberini (2007), who finds that the Colorado VCP tends to attract sites under residential development pressure.

[2] Throughout this article, the terms "enrollment" and "participation" in the VCP are used synonymously.

[3] By "the city of Baltimore," we mean the independent city that has Federal Information Processing Standards code 24510. This area does not include the surrounding and more suburban Baltimore County.

Finally, the article uses the figures presented in Deason, Sherk, and Carroll (2001) to compute the area that would be reasonably required if, instead of redeveloping the Baltimore VCP properties, equivalent projects were undertaken in more rural or suburban areas of the state. Under alternate assumptions, this total area is estimated to be between 1,238 and 6,444 acres. We conclude that if the VCP properties are redeveloped, if redevelopment can be attributed exclusively to participation in the VCP, and if the land requirements for these redevelopment projects are similar to those in Deason, Sherk, and Carroll (2001), the VCP holds promise as a good tool for reducing pressure on the conversion of open space and agricultural land. This finding should be interpreted with caution, however, because comparing the findings of this article with previous research (Alberini, 2007) suggests that, until further analysis is done, extrapolation will be difficult from one specific program and its achievements to another.

The remainder of the article is organized as follows: the next section presents background information and describes the Maryland VCP; the Previous Literature section reviews the literature that addresses brownfields and VCPs; the Model, Sample, and Data Sources section presents our econometric model of participation in a VCP and the data used to estimate this model; the next three sections (The Data, Estimation Results, Sales and Redevelopment) provide answers to our research questions; and the Conclusion section concludes the discussion.

Background

This section examines the emergence of brownfields and the subsequent policies that encourage the cleanup and reuse of these sites. It includes the general history of VCPs and specific information about the Maryland VCP. It also outlines several concurrent brownfield revitalization programs and local initiatives that may influence VCP participation.

Brownfields and Voluntary Cleanup Programs

The United States has a large supply of properties where prior industrial uses have resulted in contamination of soil, surface water, and groundwater with pollutants that are noxious to human health and ecological systems. The U.S. Government Accounting Office (GAO; 1995) estimated a nationwide total of 130,000 to 450,000 contaminated commercial and industrial sites.

Site contamination, or even suspicion of contamination, is widely believed to seriously hamper the redevelopment and reuse of land. Many observers argue that merely placing a property on federal or state registries of sites needing investigation about possible contamination inherently changes their designation to brownfields. Removal from such registries (the so-called "de-listing") would automatically remove any contamination stigma (Bartsch, Collaton, and Pepper, 1996).

Starting in the 1990s, state regulators realized that enforcement-based programs did not have sufficient funding to address the large number of contaminated sites requiring remediation and began developing an alternative approach involving voluntary cleanup programs (GAO, 1997). It has recently been suggested that states lacking financial support from EPA and states experiencing a slow progression at Superfund sites, among other factors, are more likely to adopt a VCP (Daley, 2007). By 2000, more than 90 percent of the states had a VCP in place (Meyer, 2000).

VCP offerings and requirements vary widely across states (EPA, 2005; Meyer, 2000). Many state-level VCPs grant liability relief in exchange for voluntary cleanup, provided that the cleanup is approved by the state agency in the form of a letter of no further action, a certificate of completion, or a covenant not to sue.[4]

VCPs often spell out simplified or variable cleanup standards linked to land use to protect residents and workers from exposure to contaminants. Some states allow for engineering controls, such as caps, fences, or other physical means of preventing contact with pollution, and offer institutional controls, such as permanent land use restrictions or monitoring of the contamination plume, in lieu of a more permanent cleanup. The GAO (1997) surveyed 17 states with VCPs and found that in many states more than 50 percent of the cleanups used nonpermanent remedies and selected industrial land use standards.

In addition, states frequently offer fast-track oversight of cleanup plans. This approach helps reduce the time it takes before remediation is undertaken and the uncertainty associated with stringency of cleanup standards (Meyer, 2000). At many locales, completion of voluntary cleanups at eligible sites can be combined with local, state, and federal brownfield programs that offer subsidies in the form of tax credits or low-cost loans. State VCP managers believe these programs have revealed previously unknown contaminated sites to the state agency and have encouraged cleanups when the program requirements are not too burdensome to the applicants.[5]

The Maryland VCP

The Maryland VCP was established in 1997. Any property that is or is perceived to be contaminated by controlled hazardous substances or oil (since October 2004) is eligible for enrollment and participation, including sites on federal or state registries. Sites listed on the EPA's National Priorities List (NPL), sites under active enforcement by the Maryland Department of the Environment (MDE), currently operating RCRA sites,[6] and sites contaminated after October 1, 1997 (if the applicant is the responsible party) are not eligible. Certain exceptions may apply to sites under MDE enforcement.

Eligible applicants include property owners, commercial lenders, developers, prospective purchasers, lessees, innocent purchasers, and operators. The application must contain a Phase I and Phase II environmental site assessment, a $6,000 application fee, and any other information about the property required by the Maryland VCP. The applicant may request an NFRD, which, if granted, implies no need to do remedial work, or, upon approval of the response plan and of remediation, a CoC. Both options include certain liability assurances and are recorded in the Land Records. Enrolled parcels that are underused, vacant, or located in blighted areas can also obtain tax credits from the state.

[4] A covenant not to sue is generally regarded as the strongest form of assurance, because, for all practical purposes, it is a contract by which the state commits not to sue over contamination at the site, as long as certain conditions are met.

[5] For example, the 1997 GAO study notes that public involvement requirements are generally judged inappropriate and, hence, a hurdle to remediation for the type of sites usually targeted by VCPs—industrial sites with light contamination.

[6] These sites are regulated by the laws enacted in the Resource Conservation and Recovery Act of 1976.

The liability relief offered is not absolute: so-called reopeners are possible if new contamination occurs at the property, cleanup efforts exacerbate the existing contamination, undiscovered contamination is found, or an imminent and substantial threat to human health exists. At the time of this writing, however, only two reopeners have occurred since the inception of the program (MDE). A CoC does not provide protection against third-party suits but does provide contribution protection against a party suit.[7]

Other Programs and Factors Potentially Affecting VCP Enrollment

Properties will be enrolled in the VCP if the benefits of doing so exceed the costs (see the Model, Sample, and Data Sources section). Enrollment in the Maryland VCP should, therefore, depend on the demand and supply of potentially contaminated sites in Baltimore, which, in turn, may have been shaped by a number of concurrent federal and state programs, local initiatives, and the general conditions in the real estate market.

One such federal program is the Federal Brownfield Tax Incentive, which became effective in 1997. Between 1997 and 2000, real estate developers and investors who (1) incurred cleanup costs at properties meeting certain geographic requirements or with residents of low socioeconomic status,[8] and (2) used the property to generate income, were able to write off the cleanup costs in the very same tax year and obtain a tax credit from the Internal Revenue Service. In 2000, geographical and community requirements were relaxed and developers were allowed to avail themselves of the Federal Brownfield Tax Incentive tax credits at all properties where (1) and (2) apply, regardless of location. At the end of 2006, President Bush extended the Federal Brownfield Tax Incentive.

Properties in the city of Baltimore have met the geographical and community eligibility requirements since the onset of the program, but very few census tracts met the requirements in the adjacent counties—Baltimore and Anne Arundel Counties, which can be considered natural substitutes for the city of Baltimore for investment and business purposes. This natural substitution suggests that, between 1997 and 2000, the federal tax incentives may have conferred contaminated and underused properties in the city of Baltimore a relative advantage, all else the same, over similar properties in these neighboring counties, but this comparative advantage may have become less pronounced after 2000.

Observers argue that the Small Business Liability Relief and Brownfield Revitalization Act of 2001 (enacted in January 2002) plays an important role in making property owners and developers more willing to invest in redevelopment projects at contaminated sites. This law has three main

[7] In other words, the recipient of a CoC can be sued by a third party directly, but another responsible party who has been sued by parties other than the state or a federal agency cannot demand reimbursement from the recipient of a CoC.

[8] The geographical and community characteristics requirements were as follows. For the tax incentive to apply, the property must be in (1) census tracts with poverty rates of 20 percent or more; (2) census tracts with populations of less than 2,000, where more than 75 percent of the tract is zoned for commercial or industrial use and the tracts are adjacent to one or more census tracts with poverty rates of 20 percent or more; (3) federally designated Empowerment Zones (EZ) and Enterprise Communities (EC); and (4) EPA-designated brownfields pilot sites announced before February 1, 1997. For expenses incurred from August 5, 1997, to December 21, 2000, the eligible property need only meet one of the four listed criteria. Sites listed, or proposed for listing, on the NPL are not eligible for the incentive. In addition, only expenses that are paid or incurred in connection with the abatement or control of a hazardous substance qualify for the incentive.

features. First, it provides a statutory definition of brownfields, effectively broadening the universe of properties that qualify for program assistance to include, among others, properties with petroleum contamination. Second, it establishes funding for assessment and cleanup grants and for cleanup revolving loan funds to be awarded to communities and states under the auspices of the EPA Brownfields Program. Environmental assessment studies funded with EPA grants have been considered acceptable as part of the Maryland VCP application packages since 2004, when a memorandum of understanding was signed between EPA and the State of Maryland. Third, the law provides liability relief for contiguous property owners, prospective purchasers, and innocent landowners, and it spells out the conditions for subsequent reopeners, enforcement actions, and information and public participation requirements for VCPs. The act was thus expected to substantially reduce uncertainty about liability associated with potentially contaminated sites.

Before both of these programs, which addressed incentives to private developers and property owners, EPA sought to create conditions favorable to the cleanup and redevelopment of brownfields and to economic growth in blighted areas through the Brownfield Assessment Demonstration Pilot Program, which started in 1993 and provided grants to states and local governments for site assessment, identification, characterization, and cleanup plans (but not for actual cleanup). The city of Baltimore was selected in the early rounds of grant allotment as a brownfields pilot site.[9]

Larger redevelopment efforts put forth by the city may also influence VCP participation, especially in Baltimore. In 1991, the Baltimore Development Corporation (BDC), a quasipublic organization, was formed to provide economic development services for the city (BDC, 2010). The BDC strategically buys and aggregates parcels for industrial and commercial parks to establish natural connections between city hubs and to implement the city's Urban Renewal Plans. The BDC is involved with more than 120 redevelopment projects; has focused attention on revitalizing a number of neighborhoods, including at least two former industrial areas (Carroll and Fairfield); and has established brownfield redevelopment as one of its major initiatives.

Since 1996, the BDC has completed more than 30 brownfield redevelopment projects. In fact, out of the 116 VCP sites analyzed in this article, the applicants for 6 VCP properties were either BDC or the city of Baltimore. Records from the Maryland State Department of Assessments & Taxation (SDAT) show that the city owned an additional 6 VCP properties. BDC is thus directly involved with a small number of VCP properties. Seeing the city's involvement may also encourage other private developers to participate in the VCP. Since the BDC offers resources and services to small and up-and-coming businesses, including assistance with preparing business plans, getting credit, and dealing with the tax and regulatory environment, BDC may have indirectly stimulated redevelopment of brownfields. It remains very difficult, however, to establish the extent of the effects from these influences.

Finally, as per the 1997 Maryland Smart Growth Areas Act, Baltimore is a designated priority funding area, and, as such, it is targeted for state and county funding for infrastructure and investments

[9] See Greenberg and Hollander (2006) for an examination of city and county characteristics associated with (earlier) receipt of EPA assistance under this program and Solitare and Greenberg (2002) for evidence of program generosity to economically distressed areas.

that encourage and support its growth. It is interesting to note that industrial areas, even those located outside of Baltimore, can be designated as priority funding areas.

Although it is difficult to identify the effects of local initiatives, the econometric models described later in this article account for these concurrent programs and events by interacting time period dummies with key determinants in VCP participation. These interaction terms may also account for changes in the market. One would expect the demand for contaminated sites to be stronger during periods of economic expansions, when more real estate (re)development occurs. In contrast, the supply of brownfields may increase when the economy is slow and industrial plants go out of business or relocate to other areas. Aggregate construction permit figures for the Baltimore metropolitan area from 1998 through 2006 suggest that (1) residential and nonresidential construction trends are often at odds in these areas and (2) nonresidential construction permits spiked in 1999, 2002, and 2004 and declined in other years of the 1998-through-2006 period (BMC, 2010). Residential construction in the Baltimore metropolitan area was strong for most of the study period, suggesting that this housing market was attractive and profitable.

Previous Literature

We are aware of only a handful of previous studies that have examined the economic incentives at play in VCPs. Alberini (2007) focused on the Colorado VCP, restricting attention to the Front Range counties of the state. Much like the Maryland VCP, the Colorado VCP has two participation modes. Applicants may apply for a no further action decision, or submit an actual cleanup plan. After cleanup is completed and approved, the state agency issues a no further action letter.

Alberini found that (1) actual cleanups accounted for only one-third of all applications and (2) participating properties are almost never previously listed on federal registries of contaminated sites. The program seems to attract properties that are very likely to be redeveloped soon. She also found that property values tend to be lower in truly contaminated properties but rebound almost completely after participation.

Using data from Ohio for 1989 through 1992, Sementelli and Simons (1997) found that receiving a letter of no further action from the state does not improve transaction rates for sites with leaking underground storage tanks, which continue to be bought and sold much less frequently than nontank commercial properties.

Page and Berger (2006) examined properties that entered into the VCPs in Texas and New York, emphasizing that these are only a subset of the entire universe of brownfields in those states. They empirically tested four common beliefs about brownfields, namely, that they are (1) the result of past industrial land use, (2) in abundant supply in older industrial regions, (3) primarily an urban problem, and (4) created by pollution events that took place before the Superfund statute (or similar state legislation). Texas and New York lend themselves to these research questions because of their different histories of industrial development and recent population and employment trends.

Page and Berger (2006) distinguished between previous industrial or commercial use and the brownfield's use at the time of entry into the program, finding that Texas actually has a higher percentage of sites with prior and current industrial uses than New York and that a higher share

of the New York brownfields were abandoned or vacant at the time they entered the program (21 percent versus 8 percent, respectively). Most of the Texas sites are in urban areas and in central cities (87 and 64 percent of the total, respectively, versus 49 and 30 percent for New York). They concluded that industrial uses account for most—but not an overwhelming majority (53 percent)—of the properties enrolled in the New York and Texas VCPs, and that suburban properties are surprisingly more common in the New York program. They also found that half of the properties enrolled in the New York VCP were 1 acre or less, but more than three-fourths of the properties in the Texas VCP were at least 1 acre or larger.

Since VCPs often have explicit land revitalization goals, this research is also related to the literature that has examined developer interest in reusing brownfield properties. Stated-preference surveys in Europe (Alberini et al., 2005) and in the United States (Wernstedt, Meyer, and Alberini, 2006) suggest that developers can be attracted to contaminated sites by offering them subsidies, liability relief, and less stringent regulation.[10] The appeal of these incentives varies with the developer's prior experience with contaminated properties.

De Sousa (2000) interviewed a small number (N = 18) of developers, landowners, and city officials about their perceptions of redevelopment opportunities and economic incentives for brownfields, finding that liability is judged the most important obstacle to brownfield projects. VCPs that offer protection from liability are likely to attract primarily landowners and developers, who share similar views, especially on liability attenuation.

Meyer and Lyons (2000) suggested that low property prices have played a larger role than subsidies in stimulating entrepreneurial redevelopment activity on contaminated sites and that obtaining subsidies may entail significant transaction costs that offset their value. McGrath (2000) found that contamination risk—that is, the probability that a previously used site is contaminated, based on the previous use—affects urban industrial redevelopment in Chicago both directly, and indirectly, via the differential in price before and after redevelopment.

Deason, Sherk, and Carroll (2001), De Sousa (2000), and Sigman (2005) studied the potential for substitution between infill redevelopment and development of pristine or agricultural lands—the so-called greenfields. Basing their analysis on zoning and land use ordinances for several cities, Deason, Sherk, and Carroll (2001), estimated that an industrial, commercial, and residential development project requires an average of 6, more than 2, and more than 5 times more land, respectively, in greenfield areas than they do at urban brownfield properties. These differences are

[10] Economic incentives have been advocated as potentially effective for stimulating cleanup and redevelopment of brownfields (Bartsch, Collaton, and Pepper, 1996; De Sousa, 2004; Howland, 2000, 2004; Yount and Meyer, 1999). The effectiveness of economic development incentives remains a controversial matter, even with noncontaminated properties. For example, studies suggest a statistically significant, positive relationship between tax incentives and regional and local growth and property values (Bartik, 1991; Greenstone and Moretti, 2003; Newman and Sullivan, 1988; Wasylenko, 1997), but researchers dispute the magnitude of the impacts of incentives on overall economic gains in targeted areas (Fisher and Peters, 1998; Fox and Murray, 2004; Peters and Fisher, 2002). Research in this area is afflicted by the problem that concurrent incentives make it very difficult to disentangle the effects of each, a problem that can be remedied only by deploying very careful quasiexperimental approaches with control and treatment groups (Bartik, 2004; Greenstone and Moretti, 2003). It remains difficult, however, to ascertain whether incentives were effective or if business locations and/or area redevelopment would have taken place even in their absence (Peters and Fisher, 2004).

driven by local requirements for setbacks, height of buildings, parking facilities, and percentage of the property that can be covered by buildings. De Sousa (2000) reports that, contrary to claims sometimes made by developers, in downtown Toronto, residential projects are actually more profitable at brownfields than in suburban areas (due to demand and prices of downtown residential properties).

Not everyone agrees that actual or suspected contamination is a deterrent to redevelopment. Basing her analysis on interviews with real estate agents, Howland (2004) suggested that incompatible land uses, inadequate infrastructure, and obsolete buildings are more important barriers than contamination is to the revitalization of brownfields in Baltimore. Schoenbaum (2002) found no significant difference in assessed land values, vacancy rates, property turnover, and redevelopment rates across brownfield and nonbrownfield properties in an industrial area of Baltimore from 1963 through 1999.

Model, Sample, and Data Sources

This section presents the econometric model of VCP participation (or enrollment). Estimation of this model requires both participating and nonparticipating sites. It also addresses the collection of this sample of sites and the variables that may influence VCP participation.

The Model

Consider a set of "candidate" parcels. This analysis assumes that a candidate parcel is enrolled in the VCP if the net benefits of participation are positive,[11] and that these benefits depend on characteristics of the property and surrounding neighborhood. Let VCP^* denote the net benefits of parcel i's participation in the program in year t, and assume that

$$VCP_{it}^{*} = \mathbf{x}_{it}\beta + \eta_{it}, \tag{1}$$

where x is a vector of parcel and neighborhood characteristics, β is a vector of unknown coefficients, and η is an i.i.d. standard normal error term.

We cannot observe the net benefits of participation, but we assume that properties are signed up (that is, VCP = 1) when the net benefits of participation are positive and obtain a probit equation:

$$E(VCP_{it} = 1) = \Pr(VCP_{it}^{*} \geq 0) = \Phi(\mathbf{x}_{it}\beta), \tag{2}$$

where $\Phi(\bullet)$ is the standard normal cdf. Since a site can participate in the program only once, we specify the log likelihood function as:

$$\log L = \sum_{t=1997}^{2006} \sum_{i \in \Im_t} \left[VCP_{it} \cdot \log \Phi(\mathbf{x}_{it}\beta) + (1 - VCP_{it}) \cdot \log\left(1 - \Phi(\mathbf{x}_{it}\beta)\right) \right], \tag{3}$$

[11] For an owner, the net benefits would be the appreciation in the value of the property minus the cost of remediation, the participation fee, and any other associated costs. For a developer, the net benefits would be the profits from the project, net of land acquisition costs, transformation costs, remediation costs, VCP fee, and so forth. The avoided liability and litigation costs would presumably be captured into the appreciation and proceeds from the project, respectively.

where i denotes the site, t denotes the year of the program, and $\Im_t$ is the set "at risk" at time t (that is, the set of candidate sites that have not participated as of year t).[12] Equation 3 is, effectively, a discrete-time duration model and can be easily amended to incorporate site-specific random effects, which capture unobserved parcel characteristics that may influence participation (see Greene, 2008).[13] This model is a reduced-form model.[14]

We do not have reliable information about whether a particular parcel is or was on the market at any given time, and, likewise, have no comprehensive databases documenting (re)development permits. For these reasons, we are forced to (1) omit potential or actual transactions or other projects from Equation 1 and its log likelihood counterpart Equation 3, (2) restrict attention to parcel and neighborhood characteristics as the possible determinants of participation in the VCP, and (3) gather only partial information about sales and proxies for redevelopment, which we describe, but do not explicitly model, in the Sales and Redevelopment section.

The Sample

A goal of this study is to estimate a probit equation that predicts the probability of enrollment in the VCP as a function of site and neighborhood characteristics. Estimating this probit equation requires a sample of both participating (or enrolled) sites and eligible but nonparticipating sites.

We obtained data about the VCP applications and sites from the MDE. As of December 20, 2006, more than 400 applications had been submitted to the Maryland VCP.

In this article, attention is restricted to VCP sites in the city of Baltimore since the onset of the program up to December 20, 2006. Participation (or enrollment) is defined as a direct application for either an NFRD or an actual cleanup proposal, so we lump together applications for a NFRD and a CoC. In some cases, multiple applications are submitted for the same site; in a few cases, a single site comprises multiple parcels. When multiple parties apply for the same property, enrollment is defined as occurring the time of the earliest submittal for that property.

Using these criteria, we obtained 116 enrolled sites in Baltimore. Of these 116 sites, 37 (32 percent) were signed up with the goal of obtaining a CoC, which requires submitting and executing a remedial plan; 77 (66 percent) applied directly for an NFRD; and no information was available for the two remaining sites.

[12] For example, if a site is enrolled in the program in 1999, it is dropped from the sample for all subsequent years.

[13] A required assumption in the random effects probit model is that the unobserved parcel characteristics be uncorrelated with the regressors x. It is not possible to estimate a fixed effects model, because estimation would have to rely on parcels dropping in and out of the participation status, a situation that is not possible here.

[14] We do not include among the regressors events such as actual or anticipated sales (that is, the property is on the market), other transactions, or redevelopment project status, because these events are clearly endogenous with participation. The only econometrically acceptable way to include such events in the right-hand side of equation (1) is to instrument for them. Unfortunately, in earlier analyses of commercial and industrial property prices in Baltimore (Longo and Alberini, 2006), we found that exogenous parcel or neighborhood characteristics have very little predictive power for sales events. In addition, instrumental-variable estimation procedures in this context suffer from an identification problem because we are unable to determine characteristics of properties or legislative events that are determinants of sales but not of participation in the program. This identification problem prevents us from imposing plausible exclusion restrictions.

After compiling the full list of enrolled properties, we then examined how to define the eligible but nonenrolled properties. Since any property contaminated or perceived to be contaminated by controlled hazardous substances or oil is eligible for participation, and Noonan and Vidich (1992) show that properties used for most industrial and commercial purposes have a moderate to high probability of contamination, it is reasonable to assume that any parcel designated for industrial or commercial use in Baltimore is a credible candidate for inclusion in the sample (see Page and Berger, 2006; Sigman, 2005).

The first step in constructing our sample was to draw a random sample of N = 131 industrial and commercial parcels out of the universe of all such sites in Baltimore. To make these randomly selected parcels proper counterparts for the enrolled properties, we formed predictions for the likelihood of contamination (PROBCON) based on current land use at the site and on the estimated probabilities reported by Noonan and Vidich (1992) and included these probabilities as a control in our probit regressions. (We also included a companion missing-value dummy when the records from SDAT did not contain specific land use information.)

For each of the 10 years of the study period (1997 through 2006), the sample we used for the probit model consisted of the enrolled parcels that had not signed up yet, plus all of the 131 above-mentioned nonenrolled sites. This resulted in a total of 247 properties and 2,097 observations.

Other Independent Variables

Parcel and neighborhood characteristics act as a proxy for the net profits of participation. These characteristics include the size of the parcel (SIZE), a dummy for the presence of a building or improvement (BUILDING), an interaction between the presence of a building and the year of construction of the oldest building on the premises (BUILDINGYRBUILT), and the capital intensity (CAPITAL) of the parcel, which we define as the total square footage of the building divided by the area of the property.

These variables act as a proxy for remediation and demolition costs. Heavily built sites may differ from others in terms of demolition and cleanup costs because of toxic construction materials (for example, asbestos, heavy metals). To avoid losing observations to the analysis because of missing values, we created companion dummy variables to denote missing values, recoded the original missing values to zero, and included both the regressors of interest and the companion missing value dummies in the right-hand side of the probit regressions.

A parcel's value should also be influenced by its location and use. Therefore the following variables are also included as regressors in the probit model: distance to the central business district (CBDDIST) and to major roads (MJRDDIST),[15] whether the site is for industrial use (INDUSTRIAL), surrounding land use, and distance to the nearest residential zone (RESZNEDIST). We included the latter variable because Howland (2003, 2004) discussed how potential buyers in Baltimore are reluctant to purchase industrial property near residential areas because of incompatible activities and greater political barriers. Regarding land use, we used 1996 land use data from the Maryland Department

[15] Data from the Maryland State Highway Administration.

of Planning to form 500- and 1,500-meter buffers around each property and computed the percentage of the area of the buffer in various types of land use, such as low-, medium-, and high-density residential, industrial, and commercial.

A parcel's eligibility for state Enterprise Zone incentives (usually in the form of tax credits if a business is established on the premises) and for federal Empowerment Zone incentives (dummies ENTZNE and EMPZNE) may also influence its participation in the VCP. These incentives are associated with setting up a business or offering employees certain educational opportunities at specific locations, and are unrelated to contamination and cleanup. They may, nevertheless, increase the attractiveness of a location to a developer and to prospective buyers.

Whether VCP sites tend to be clustered is of interest because it reflects either some effect on surrounding properties (that is, enrolled sites induce further enrollment) or simply the spatial concentration of the existing supply of contaminated sites. We controlled for this tendency with the number of sites previously enrolled in the VCP within a 1,500-meter buffer of each property (LNEARVCPS). The last set of independent variables included median house values (MDVALHS) and socioeconomic characteristics of the residents in the neighborhood, measured at the 2000 Census tract level.

The Data

This section further describes the types of properties that are enrolled in the VCP. Univariate statistical comparisons are made between participating (or enrolled) sites and nonparticipating sites. The section concludes with a discussion of the changing nature of the VCP and the types of properties that tend to be enrolled and, in turn, how these changes are accounted for in the econometric model.

Description of Properties

For 92 of the 116 sites enrolled in the VCP, we identified the corresponding parcel(s) in the SDAT database, and appended information about the parcel, its exact location (latitude and longitude), structures, assessed value, and recent sales (if any). The 116 participating sites were actually composed of 172 properties, because in 21 cases one VCP application consists of multiple adjacent parcels.[16] The same type of parcel information is also available for the 131 nonenrolled properties.

Exhibit 1 displays descriptive statistics of the sample. The average parcel in the sample covers about 5 acres and is located a little more than 2 miles from the CBD. Nearly all parcels (79 percent) have a building or other improvement, which accounts on average for 77 percent of the total property area (variable CAPITAL). Because of the criteria used for constructing the sample, industrial properties account for more than 40 percent of all parcels.

Exhibit 1 also shows that we were able to impute the prior probability of contamination for 175 properties. Regarding additional neighborhood characteristics, half of the parcels in the sample are

[16] Specifically, out of the 116 VCP sites, 95 sites consist of a single parcel, 12 sites of 2 parcels, 3 sites of 3 parcels, and single sites each with 4, 5, 6, 7, 8, and 14 parcels.

Exhibit 1

Descriptive Statistics

Variable	Description	N Valid Obs	Mean	Std Deviation
SIZE	Area of parcel in acres	247	5.390	12.020
CBDDIST	Distance to CBD (Inner Harbor) in meters	246	3,764.99	2,321.17
BUILDING	Building or other improvement present (dummy)	247	0.794	0.406
YRBUILT	Year the oldest building was built	52	1,943.31	30.944
CAPITAL	Capital intensity	247	0.768	1.228
MJRDDIST	Distance to nearest major road in meters	246	466.375	481.852
PROBCON	Predicted probability of contamination	175	0.475	0.304
PROBCONMISSING	Probability of contamination undefined (dummy)	247	0.291	0.455
ENTZNE	Located in Enterprise Zone (dummy)	246	0.516	0.501
EMPZNE	Located in Empowerment Zone (dummy)	246	0.236	0.425
LNEARVCPS	Number of properties previously enrolled in VCP within 1,500 m buffer (all years)	247	2.530	4.413
INDUSTRIAL	Zoned industrial (dummy)	247	0.417	0.494
PCTIND	Percent of land in industrial use within 1,500 m buffer	246	0.196	0.212
PCTIND500M	Percent of land in industrial use within 500 m buffer	246	0.257	0.310
RESZNEDIST	Distance to nearest residential zone in meters	246	155.439	202.877
MDVALHS	Median housing value in census tract (2000 dollars)	245	73,267	36,745
PCTPOVERTY	Percent of census tract population living below poverty line	246	0.237	0.125
PCTOWNERS	Percent of residents in census tract who own home	246	0.481	0.228
PCTBLACKS	Percent of African Americans in census tract	246	0.364	0.335
PCTHISPANICS	Percent of Hispanics in census tract	246	0.024	0.027
PCTCOLLEGE	Percent of people with college degree in census tract	246	0.175	0.150

CBD = central business district. Obs = observations. VCP = voluntary cleanup program.

Note: Full sample (N = 247).

located in a state Enterprise Zone and 23 percent are in a federal Empowerment Zone. On average, industrial uses account for about 25 percent of the land use within a 500-meter radius around the properties and nearly 20 percent within 1,500 meters. The median housing value in the surrounding census tract is on average about $73,000.

Comparison Across VCP and Nonparticipating Sites

Maps of the VCP sites suggest that participating properties are more likely to be in areas where economic inducements, such as those associated with state Enterprise Zones and federal Empowerment Zones, are offered to firms (see exhibit A-1 in appendix A). Although they tend to be roughly the same distance from the central business district, participating sites tend to be farther from

major roads than nonparticipating eligible properties (see exhibit A-2 in appendix A). Participating sites are more likely to be surrounded by industrial properties and tend to be located farther away from residential zones (see exhibit A-3 in appendix A). These spatial patterns confirm that the probit model should control for industrial versus another use of the parcel, for the prevalent uses in the neighborhood, and for distance to the nearest residential area, as mentioned in Model, Sample, and Data Sources section.

We compared the means of all variables across nonparticipating and participating sites in the sample in exhibit 2. This table shows that participating properties tend to be considerably larger than nonparticipating eligible properties and tend to be somewhat less likely to contain buildings or other improvements.[17] As expected, enrolled sites have a higher predicted probability of contamination.

Exhibit 2

Comparison of Means of Variables for Nonparticipating (VCP = 0) and Participating (VCP = 1) Parcels

Variable	VCP = 0			VCP = 1			T Statistic
	N Valid Obs	Mean	Standard Deviation	N Valid Obs	Mean	Standard Deviation	
SIZE	131	1.188	5.940	116	10.134	15.046	– 6.003**
CBDDIST	131	3,834.800	2,579.010	115	3,685.470	1,995.580	0.511
BUILDING	131	0.901	0.300	116	0.672	0.471	4.476**
YRBUILT	5	1,917.000	26.833	47	1,946.110	30.261	– 2.277**
CAPITAL	131	1.141	1.305	116	0.347	0.982	5.435**
MJRDDIST	131	322.770	421.112	115	629.959	496.055	– 5.197**
PROBCON	100	0.278	0.183	75	0.736	0.225	– 14.419**
PROBCONMISSING	131	0.237	0.427	116	0.353	0.480	– 2.010*
ENTZNE	131	0.427	0.497	115	0.617	0.488	– 3.020**
EMPZNE	131	0.168	0.375	115	0.313	0.466	– 2.667**
LNEARVCPS	131	2.416	4.569	116	2.722	4.132	– 0.553
INDUSTRIAL	131	0.145	0.353	116	0.724	0.449	– 11.164**
PCTIND	131	0.080	0.130	115	0.327	0.211	– 10.864**
PCTIND500M	131	0.084	0.187	115	0.454	0.305	– 11.277**
RESZNEDIST	131	103.986	164.188	115	214.051	226.290	– 4.314**
MDVALHS	130	75,297.69	45,078.93	115	70,972.17	24,094.09	0.951
PCTPOVERTY	131	0.260	0.137	115	0.211	0.104	3.183**
PCTOWNERS	131	0.409	0.235	115	0.563	0.190	– 5.648**
PCTBLACKS	131	0.474	0.339	115	0.239	0.285	5.903**
PCTHISPANICS	131	0.023	0.028	115	0.025	0.027	– 0.635
PCTCOLLEGE	131	0.177	0.144	115	0.172	0.158	0.250

Obs = observations. VCP = voluntary cleanup program.

** = significant at the 5-percent level. ** = significant at the 1-percent level.*

Note: Statistical comparison of the means is done using t-tests of the null hypothesis that the difference in the means is zero.

[17] Sometimes multiple parcels were combined into the same application to the VCP (and into the same redevelopment project). The average size of a VCP site is 9.82 acres for the sites consisting of 1 parcel, 13.52 acres for the sites consisting of 2 parcels, 4.49 acres for the sites consisting of 3 parcels, 1.5 acres for the one site consisting of 4 parcels, 1.21 acres for the one site consisting of 5 parcels, 54.34 acres for the one site with 6 parcels, 1.98 acres for the one site with 7 parcels, 6 acres for the one site with 8 parcels, and 1.44 acres for the one site with 14 parcels. This suggests that in some cases it was necessary for developers to combine several very small parcels together to get a site of acceptable size for redevelopment.

Enrolled properties tend to be less capital intensive. Buildings at enrolled sites are likely slated for demolition during redevelopment, thus a less capital-intensive site may be more attractive because of lower demolition costs. Howland (2004) interviewed Baltimore real estate agents and industrial property owners and found that the expense of removing obsolete structures is one barrier to redevelopment.

There are no systematic differences across the two groups of properties for housing values and share of residents with a college degree. The proportion of residents who own their homes—as opposed to renting them—is higher near enrolled properties than near nonparticipating properties. The proportion of residents living in poverty tends to be lower surrounding enrolled properties. Regarding race and ethnicity of the neighborhood, enrolled properties tend to be located in neighborhoods with fewer African Americans, but no systematic difference exists regarding the proportion of people of Hispanic heritage.

Features of Participating Sites

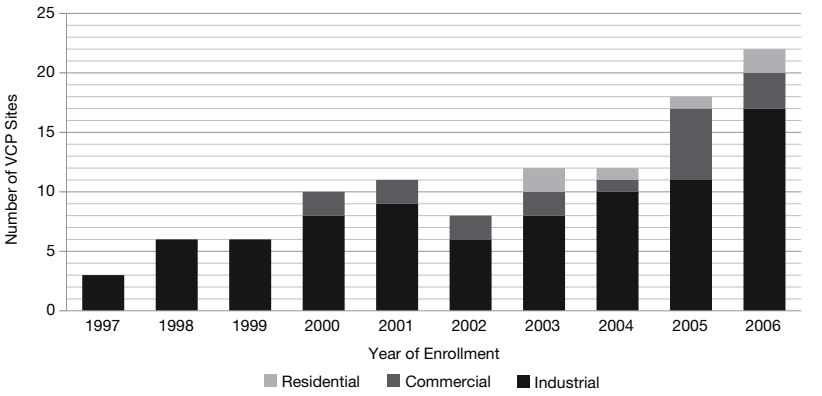
We checked for possible overlapping between VCP participation status and the other programs described in the Background section (Other Programs and Factors Potentially Affecting VCP Participation) but found that only one VCP property received a grant from the EPA under the Brownfields Program established by the Small Business Liability Relief and Brownfields Revitalization Act of 2001. None of the nonparticipating properties received funding under this program. Only five properties that received assessment grants under the earlier EPA Brownfield Assessment Demonstration Pilot Program subsequently entered the VCP program.

Among the VCP properties, we found no obvious differences between those that applied for an NFRD and those for which a cleanup plan was submitted, except that the predicted probability of contamination is greater for the latter. Among enrolled properties, those in industrial use tend to be larger than commercial properties.

Exhibit 3 displays the distribution of land use at Baltimore City participating sites by the year of enrollment, showing that (1) participation has picked up steam since the inception of the program,

Exhibit 3

Land Use at VCP Sites by Year of Enrollment



VCP = voluntary cleanup program.

with the largest enrollment (22 sites) in 2006, and (2) industrial properties make up most of the enlisted sites. Commercial properties started being enrolled in the program starting in 2000, but they still account for a small fraction of all sites. Residential properties are even less common.

Perusal of exhibit 3 suggests that, all else the same, participation rates and hence the likelihood of participation have changed over time. This change may have occurred because of changes in the eligibility criteria, the establishment of concurrent programs that target similar properties (see the Background section [Other Programs and Factors Potentially Affecting VCP Participation]), changes in the economic climate of the city, and changes in the real estate market. To account for these changes, we grouped the 10 years from the inception of the program to 2006 into four discrete periods: 1997 through 2000, 2001, 2002 through 2003, and 2004 through 2006. We then interacted key regressors with dummies for those periods.

The first period (1997 through 2000) captures the early years of the VCP, the most restrictive version of the federal Brownfields Tax Incentive and one city administration.[18] The second period, consists of a single year (2001) to allow for the disruption to business associated with the events of September 11, 2001, and because of subsequent policies and programs affecting contaminated sites that had not yet taken effect. With the third period (2002 and 2003), we hoped to capture the incentives associated with the Small Business Liability Relief and Brownfields Revitalization Act, which implied changes in funding for assessment and cleanup of contaminated sites and substantial limitation of Superfund liability for prospective purchasers and owners. In 2002, Baltimore voters passed the Economic Development Loan Bond Issue, which included $2 million for brownfield redevelopment (BDC, 2005). A change in political climate also occurred, starting with the beginning of 2003, when Robert Ehrlich, a Republican, took over as Governor of Maryland from Parris Glendening, a Democrat. It is possible that this shift in state government may have changed priorities for state agencies.

Finally, in 2004, the VCP was changed so that it began to admit oil pollution sites. These sites are likely to differ in size and use relative to sites contaminated by other hazardous wastes. For example, gas stations are comparatively small and are considered a commercial use.[19]

Basing our analysis on these considerations, we entered in the model the variable SIZE, a likely determinant of participation; SIZE2, the interaction term between SIZE and the dummy denoting the second period of the study (2001); SIZE3, the interaction term between SIZE and the third period of the study (2002 through 2003); and SIZE4, the interaction term between SIZE and the fourth period (2004 through 2006). This inclusion allows for the effect of property size on the probability of participation to vary over time.

[18] In December 1999, a change occurred in Baltimore's government when Mayor Martin O'Malley took over from Kurt Schmoke, who had been mayor since 1987. This change in city government may have resulted in changes of several aspects of city law, taxation, redevelopment efforts, and so forth. It seems reasonable, however, to include the first year of his administration within our first period because, during his first term as a mayor, O'Malley emphasized safety and crime reductions. This emphasis and any other regime changes were unlikely to have had an immediate effect on redevelopment and investment opportunities.

[19] The program was also amended to accept application packages that included Phase I and Phase II environmental assessment studies funded through grants from the EPA Brownfields Program. As discussed at the beginning of this section, however, only one property appears to have availed itself of this opportunity.

Estimation Results

Exhibit 4 reports the results for the random effects probit model of participation.[20] We present three specifications. Specification (A) is the base specification, which includes size of the property and interactions between size and time period, in addition to the regressors listed in the Model, Sample, and Data Sources section (Other Independent Variables). Specifications (B) and (C) include census tract characteristics (as of 2000) to capture socioeconomic differences in neighborhood character and blighted areas.

Exhibit 2 had suggested that the VCP tends to attract larger sites. This tendency would appear to be a recent phenomenon, because the results of all the probit specifications in exhibit 4 suggest that, in the early years, the program actually attracted smaller properties, but that trend was subsequently reversed, as implied by the signs and significance levels of the coefficients on SIZE, SIZE2, SIZE3, and SIZE4.

Exhibit 4

Results of Random Effects Probit Regression of VCP Participation

Variable	(A)		(B)		(C)	
	Coefficient	T Stat	Coefficient	T Stat	Coefficient	T Stat
INTERCEPT	– 1.6806	– 4.93**	– 1.2733	– 2.81**	– 1.9840	– 4.62**
SIZE	– 0.0124	– 1.81^	– 0.0128	– 1.87^	– 0.0127	– 1.84^
SIZE2	– 0.0020	– 0.13	– 0.0022	– 0.14	– 0.0021	– 0.13
SIZE3	0.0090	0.98	0.0087	0.94	0.0089	0.95
SIZE4	0.0301	3.72**	0.0304	3.73**	0.0312	3.78**
CBDDIST	0.0000	0.02	– 0.0000	– 0.35	– 0.0000	– 0.11
BUILDING	– 0.2201	– 1.34	– 0.2271	– 1.36	– 0.2319	– 1.4
BUILDINGYRBUILT	– 0.0001	– 0.64	– 0.0001	– 0.8	– 0.0001	– 0.77
YRBUILTMISSING	– 0.6347	– 3.18**	– 0.6919	– 3.35**	– 0.6947	– 3.34**
CAPITAL	– 0.1881	– 2.67**	– 0.1946	– 2.72**	– 0.1898	– 2.65**
MJRDDIST	– 0.0001	– 1.42	– 0.0001	– 0.92	– 0.0001	– 0.96
PROBCON	0.4593	1.73^	0.4418	1.65^	0.4182	1.55
PROBCONMISSING	0.1414	0.73	0.1428	0.73	0.1296	0.66
ENTZNE	– 0.0143	– 0.09	– 0.0656	– 0.37	– 0.0097	– 0.06
EMPZNE	0.0645	0.4	0.0110	0.06	0.0562	0.35
LNEARVCPS	0.0592	5.13**	0.0620	5.22**	0.0601	5.07**
INDUSTRIAL	0.4536	3.27**	0.4273	3.04**	0.4320	3.07**
PCTIND	0.5401	1.36	0.5251	1.32	0.1941	0.39
RESZNEDIST	0.0007	2.37*	0.0007	2.36*	0.0007	2.42*
MDVALHS			– 0.0000	– 1.29		
PCTCOLLEGE			0.2803	0.44		
PCTPOVERTY					1.3077	1.45
PCTOWNERS					0.4786	0.89
PCTBLACKS					– 0.2992	– 0.93
Log Likelihood	– 351.86906		– 350.71099		– 350.78477	

VCP = voluntary cleanup program.

*^ = significant at the 10-percent level. * = significant at the 5-percent level. ** = significant at the 1-percent level.*

Note: Dependent variable: participation in year T of the program.

[20] The correlation between any two error terms within the same site is generally small (about 0.03) and significant only at the 10-percent level. Nevertheless, random effects were incorporated to obtain the correct standard errors.

It is possible that, in the later years, developers became familiar with the workings of the program and saw opportunities for economies of scale in assessment, development, and cleanup; moreover, larger sites cater to large projects and can be subdivided. This result may also have been a consequence of the Small Business Liability Relief and Brownfields Revitalization Act. Before this law, holding the probability of contamination per acre the same, a developer or owner would be more likely to face exposure to liability (or be more heavily exposed) with larger properties. With the law in effect, which limits or eliminates liability for certain parties under specific conditions, larger sites become comparatively more attractive.

This finding also suggests that the VCP did not prove to be particularly attractive to (closed) gas stations, which are generally small properties, after the VCP eligibility rules were amended in 2004 to include petroleum-contaminated sites. Conversations with MDE staff suggested that very few leaking underground storage tank (LUST) sites were signed up with the VCP, probably because the VCP has relatively more stringent environmental assessment and cleanup requirements. Gas station owners and operators would have found the Maryland LUST program more attractive because, until the middle of 2005, this program would have reimbursed them for the cost of remediation.[21]

The probit model confirms that participation is also more likely to occur among sites without buildings (an effect that is not significant at the conventional levels, however) and among properties with lower capital intensity, suggesting a preference for sites with lower demolition and remediation costs. Distance to the central business district or to major roads does not seem to be an important driver of participation. This finding should be interpreted with caution, because it may be due to collinearity and to the use of imperfect proxies for site access. Distance to the central business district is correlated with several other spatial characteristics, and distance to major roads may not fully capture how easy or difficult it is to access a particular property in an urban setting.

As expected, participation is positively and significantly associated with the prior probability of contamination—in other words, the program is attracting sites that one would truly expect to be contaminated. That does not mean, of course, that the property is necessarily cleaned up, and indeed about two-thirds of the VCP applications, as discussed in the Model, Sample, and Data Sources section, requested an NFRD.

There is no evidence of an independent effect of Enterprise and Empowerment Zone designations. However, these designations are correlated with land use, location, and size of the site. Once again, it is thus difficult to say whether this result is genuine or an artifact of collinearity. Most likely, VCP properties—brownfields, for all practical purposes—are typically in abundant supply in blighted areas that are also addressed by state and federal economic development programs.

The results suggest that participation is more likely among sites zoned for industrial use and grows with distance from residential areas and with the percentage of the surrounding land designated

[21] The fact that the VCP attracted larger sites in more recent years is in sharp contrast to general nonresidential development and building trends. Data from the Baltimore Metropolitan Council indicate that in Baltimore City the average size of such development projects followed an inverted-U trend over the study period and had reached its lowest levels (about 12,000 sq. ft.) by 2004 through 2006. The square footage of the average project has been declining steadily over the study period in the entire Baltimore metropolitan area (about 9,000 sq. ft. in 2004 through 2006).

as industrial (the latter is statistically insignificant at all the conventional levels).[22] The coefficient on LNEARVCPS suggests that the number of nearby properties previously enrolled in the VCP is positively associated with the probability of enrollment. It is possible that successful participation encourages enrollment of other nearby sites. Alternatively, this finding may also be due to the spatial clustering of brownfields or to other unobserved amenities.

Specification (B) adds the median housing value and the education level of the residents in the census tract around each property, although neither variable has an independent effect on the likelihood of enrollment. These variables were intended to act as a proxy for up-and-coming versus blighted neighborhoods, but their effect (if any) is probably already captured in other site and neighborhood characteristics. Specification (C) includes other characteristics of the residents, namely the percentage of people who live in poverty, own their homes, and are African American. In both (B) and (C), likelihood ratio tests indicate that the newly added census-tract variables are jointly insignificant.

To get a sense of the magnitude of the probit coefficients, using specification (A) we computed the annual probability of participation (or enrollment) for a hypothetical industrial-use parcel of average size, distance to the CBD, capital intensity, and in an Enterprise Zone. We assumed that this site had the average prior probability of contamination, was surrounded by the average extent of industrial land, and was at the average distance from residential areas. For a parcel with these characteristics during the first period of the program (1997 through 2000), the probability of enrollment in any given year was 9.36 percent. Increasing the size of this average parcel by a standard deviation (that is, by 12.02 acres above the original 5.43 acres) slightly decreased the probability of enrollment from 9.36 to 7.12 percent.

The story changes in more recent years (2004 through 2006). A parcel that was average in all respects and was zoned for industrial use would have had a greater annual probability of participation (12.39 percent), which increases to 17.31 percent if the parcel's size is increased by a standard deviation above the average. If this larger parcel during the most recent years of the program was located an additional 0.25 miles from the nearest residential zone (about a two standard-deviation increase), then the probability of participation would increase from 17.31 to 25.10 percent.

Sales and Redevelopment

A natural issue to address is whether properties that signed up for the VCP did so because they had just been or were about to be purchased or sold. We did not include sales events in the right-hand side of the probit equation because we were unable to find good instruments for them and for related econometric difficulties, but we checked whether participating sites were bought or sold around the time of enrollment in the program.

Of the 247 properties in the sample, 100 had no records of sales in recent years (after 1990). These 100 parcels with no recent sales were evenly split between VCP participants and nonparticipants

[22] The probit regressions reported in exhibit 4 used the 1,500-meter buffer when computing the percentage of surrounding land dedicated to industrial uses, but we obtained the same result when we used smaller buffer sizes (for example, 500 meters) to capture closer neighbors of each property in the sample.

(51 and 49 parcels, respectively). Of these 100 parcels, we were unable to identify 22 in the SDAT records. The remaining 78 were mostly commercial and industrial parcels (49 and 22 parcels, respectively) and were properly documented in the Maryland taxation data. Of these 78 well-identified parcels, 29 (37.18 percent) were VCP participants.

The remaining properties had been bought and sold during the 1990-through-2006 period for a total of 224 sales. When we restricted our attention to the 185 sales that occurred during or after 1997 (that is, since the beginning of the VCP), we found that 92 of these sales were among 67 non-VCP properties and the remaining 93 sales were of 55 VCP properties. Between 1997 and 2006, about 66 percent of the sold non-VCP sites were sold once, 27 percent were sold twice, 7 percent were sold three times, and none were sold four times. In contrast, 53 percent of the sold VCP sites were sold once, 34.55 percent were sold twice, 9.09 percent were sold three times, and 3.64 percent were sold four times.

Of the 93 sales of VCP sites, 72 occurred at properties that received application approval as of December 20, 2006. Of these sales, 39 occurred before the VCP application was approved, and 33 occurred after approval. Of these sales, 11 took place within 3 months of the approval of the VCP application, but the lion's share (52 sales) took place 6 months after application approval or later. Of these 52 sales, 20 were properties that had a proposed cleanup plan. Taken together, these facts suggest that the properties enrolled in the VCP come from a pool of properties that are sold or bought no less than the nonparticipating sites.

The next logical issue to follow this discussion of transaction activity of VCP properties is whether parcels enrolled in the Maryland VCP are likely to be redeveloped soon. Possibly, but we believe that redevelopment is unlikely to bring significant land use changes. Of the 58 properties that had received an NFRD letter or a CoC within the study period, residential use was explicitly prohibited at 44 sites (75.80 percent). At 12 sites (20.69 percent), only limited residential development was allowed. These restrictions are meant to protect the public from possible exposures to contaminants, while at the same time trying to encourage some form of reuse.

We obtained the specific land use before and after VCP completion for 40 of the 58 properties that completed the program. Only 8 properties changed uses after completion: most were converted from parking lots (n = 3), warehouses (n = 2), and manufacturing facilities (n = 1) to offices. Only 2 properties were converted to residential use (the first was initially a warehouse and the other a manufacturing facility).

Taken together with the likelihood that enrollment is greater at industrial properties in industrial areas and increases with distance from residential neighborhoods, the above evidence suggests that the vast majority of redevelopment would either keep the existing land use or convert the parcel to nonresidential uses.

Infill redevelopment is touted as helping to meet smart growth goals and as avoiding conversion of open space, so it is natural to ask how well the VCP is doing in this respect. As of December 2006, a total of 1,175 acres were enrolled in the VCP in the city of Baltimore alone.

Deason, Sherk, and Carroll (2001) considered eight brownfield properties in the city of Baltimore and assumed redevelopment as office buildings, commercial facilities, or homes (see exhibit B-1 in

appendix B). They calculated the land area that would be necessary if such redevelopment projects took place in surrounding suburban areas (Baltimore, Kent, and Frederick Counties). They consistently found that, based on local zoning, such redevelopment projects would require larger land areas in these latter three counties than in the city of Baltimore.

Assuming that all of the participating 1,175 acres are redeveloped and remain in their use at the time of enrollment, we used the land area "ratios" derived by Deason, Sherk, and Carroll (2001) to estimate the amount of open space that the VCP may have deterred from being developed (see exhibit B-2 in appendix B). We considered greenfields in Baltimore County as likely substitutes for infill development because this rural or suburban area surrounds the city of Baltimore and is part of the overall metropolitan area. For purposes of this illustrative calculation, we assumed that VCP properties can accommodate similar projects as any other properties.

Basing our analysis on these assumptions, if the urban redevelopment projects on VCP properties were built on greenfields instead of brownfields, they would require as many as 6,444 acres in suburban Baltimore County under generous assumptions about the conversion "ratio" between city and suburban projects and 1,238 acres under more conservative assumptions. This illustration suggests that if VCP properties are indeed all redeveloped, if redevelopment can be attributed solely to the VCP, and if greenfields and brownfields are truly substitutable, then the VCP is potentially an effective tool to deter open space conversion.

Conclusions

To understand the promise and potential of voluntary cleanup programs (VCPs) in promoting remediation and reuse of brownfields, this study focused on enrollment and participation in the Maryland VCP, which began in 1997. To ensure a homogeneous legal and tax environment, we restricted attention to the 116 sites in the city of Baltimore that had participated as of the end of 2006.

Participation in the Maryland VCP has led to the identification and environmental assessment of 1,175 acres of contaminated land in the city of Baltimore alone. The vast majority of applications (66 percent) requested a No Further Requirements Determination (NFRD) on the part of the state agency, suggesting that actual cleanup is not undertaken at most of the sites. We believe that participation in the program is often motivated by developers' or business owners' desire to protect themselves from future environmental liability. A clean bill of health may, of course, also increase the value of property (and of any redevelopment project on site). In that sense, the evidence from Baltimore confirms the findings for the Colorado VCP reported in Alberini (2007).

One major issue to tackle when studying the determinants of voluntary cleanup is the identification of "counterfactuals," namely properties that are potentially eligible for the program but are not enrolled. Given Noonan and Vidich's 1992 estimates of the a priori probability of contamination for commercial and industrial properties, we believe that it is reasonable to consider virtually all commercial and industrial parcels in Baltimore as potential candidates for the VCP (see Page and Berger, 2006; Sigman, 2005). We therefore compared the VCP properties with a sample of similar size properties selected at random from the universe of industrial and commercial properties in Baltimore. Probit regressions confirm that participation is more likely among industrial sites

located in industrial areas and less likely in the presence of improvements and heavy building capitalization. They also suggest that the distances to the central business district and major roads, respectively, are not very important. Even more important, the probit regressions point to the changing nature of the program—or of the sites that tend to be attracted to the program. In the first few years of the program, smaller properties tended to be attracted into the VCP. Most recently, however, participation has been more likely among larger properties.

Given the surrounding land use and the restrictions imposed on the use of the property by the VCP approval, it is likely that such industrial properties will be kept in industrial or perhaps commercial use but will not be turned into residential projects. This likelihood is supported by recent home construction trends. Records from SDAT show that, from 1996 to 2007, of the 371 single-family homes built in the city of Baltimore, only 1 was built in an industrial use area and 4 were built in a commercial use area (see exhibit A-4 in appendix A). In fact, only 21.8 percent of these homes are within 1 mile of an industrial area, and most (77.1 percent) are more than 0.5 miles from a VCP site. This finding is in sharp contrast with the findings in Alberini (2007), who concludes that properties enrolled in the Colorado VCP were most likely under residential development pressure.

Assuming that all of the participating 1,175 acres are redeveloped and remain in their use at the time of enrollment, and using the land area "ratios" derived by Deason, Sherk, and Carroll (2001), we estimate that if the urban redevelopment projects on VCP properties were instead built on greenfields, they may require between 1,238 and 6,444 acres in suburban Baltimore County. Because most of the enrolled sites tend to remain in nonresidential uses, it appears that VCPs, at least in the case of Baltimore, may encourage commercial and industrial activities to take place on already contaminated brownfields, thus leaving pristine land available as open space or for residential uses.

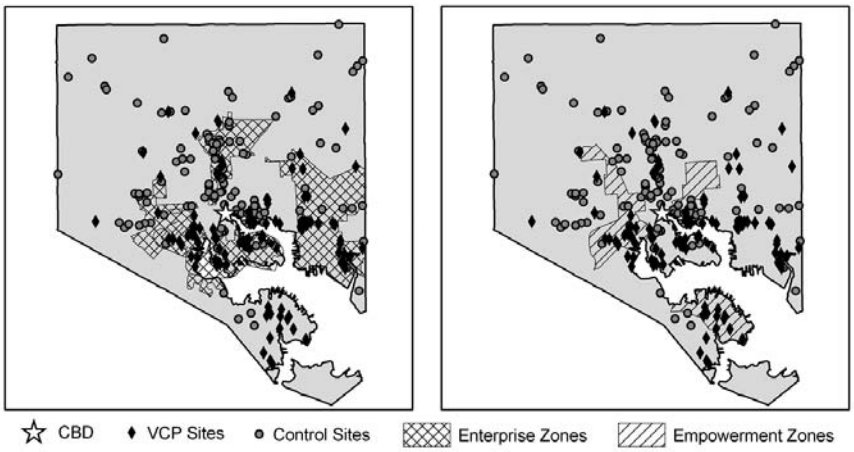
The findings should, as always, be interpreted with caution. This study is specific to the city of Baltimore, and, given the limited body of research about VCPs and their context-specific results, it would be necessary to conduct more research at a variety of locations before attempting to extrapolate from this study's locale to another. Future research endeavors might compare the VCP in a city like Baltimore with VCPs of other cities that have experienced similar declines in population and manufacturing and blue-collar jobs.

Another limitation of the study is that, given the many concurrent local and federal programs in place at the same time as the VCP, it is impossible to isolate the effect of any single policy in promoting brownfield cleanup and redevelopment. Thus, in conducting future research, it would be important to control carefully for previous brownfields pilot status and for the generosity of assistance and incentives to environmental assessment and redevelopment.

Appendix A. Maps of Sample Sites in Baltimore, Maryland

Exhibit A-1

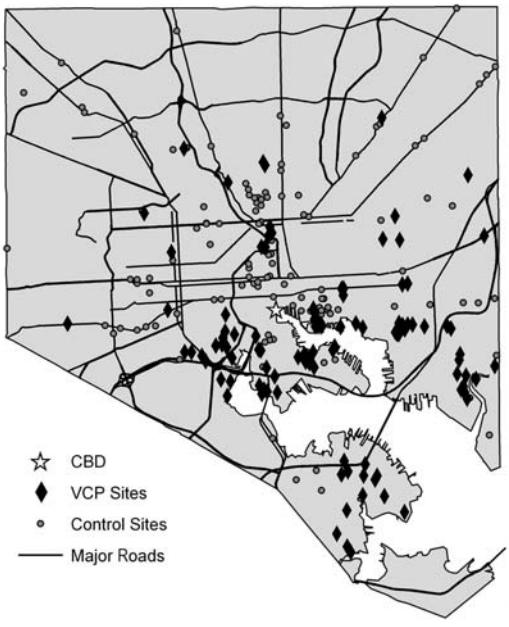
Enterprise and Empowerment Zones



CBD = central business district. VCP = voluntary cleanup program.

Exhibit A-2

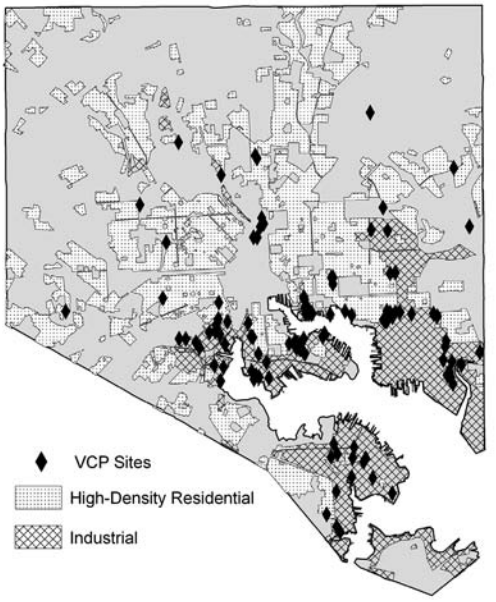
Baltimore Major Roads



CBD = central business district. VCP = voluntary cleanup program.

Exhibit A-3

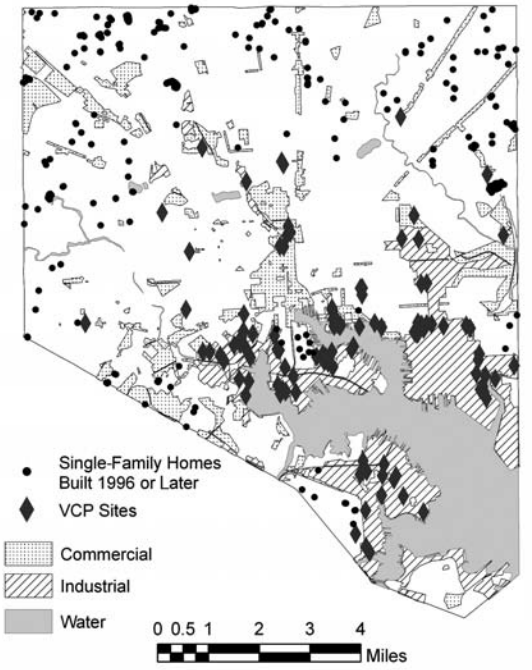
Baltimore 1996 Land Use



VCP = voluntary cleanup program.

Exhibit A-4

Land Use (1996) and New Home Construction



VCP = voluntary cleanup program.

Appendix B. Calculation of Land Area Conversion Ratios

Exhibit B-1

Property-Specific Conversion Ratios
Calculations for Brownfield Properties in the City of Baltimore

Property	Size (Acres)	Assumed Reuse	Required Area if in Baltimore County (Acres)	Ratio
1	15	Office buildings	18.37	1 : 1.22
2	4.5	Redeveloped comm. facility	9.18	1 : 2.04
3	0.7	Office buildings	4.59	1 : 6.12
4	2.75	Two office buildings	5.42	1 : 1.97
5	6	Residential multifamily complex	6.00	1 : 1
6	1.3	Residential, 26 townhomes	2.25	1 : 1.73
7	2.8	Residential	2.23	1 : 0.80
8	0.17	Two-story office building	0.67	1 : 3.94

Source: Deason, Sherk, and Carroll (2001)

Exhibit B-2

Development Conversion Rates Assumed in This Article
(See the Sales and Redevelopment section.)

Land Use	N	Total Acres	"Ratio"	Total Required for Equivalent Projects in Suburban Areas
Generous assumptions*				
Industrial	83	975.02	6.24	6,084.12
Commercial	14	62.86	3.0875	194.08
Residential	6	32.79	1.86	60.99
Other	13	104.86	1.00	104.86
Total				6,444.05
More conservative assumptions**				
Industrial	83	975.02	1.00	975.02
Commercial	14	62.86	2.00	125.72
Residential	6	32.79	1.00	32.79
Other	13	104.86	1.00	104.86
Total				1,238.39

** Means of the conversion ratios for the Baltimore projects reported in Deason, Sherk, and Carroll (2001), except for industrial use projects, where the figure in this table (6.24) is the average for industrial projects nationwide. (Deason, Sherk, and Carroll [2001] do not examine industrial projects for Baltimore.)*

*** Median conversion ratios. The same exceptions as in * apply.*

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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

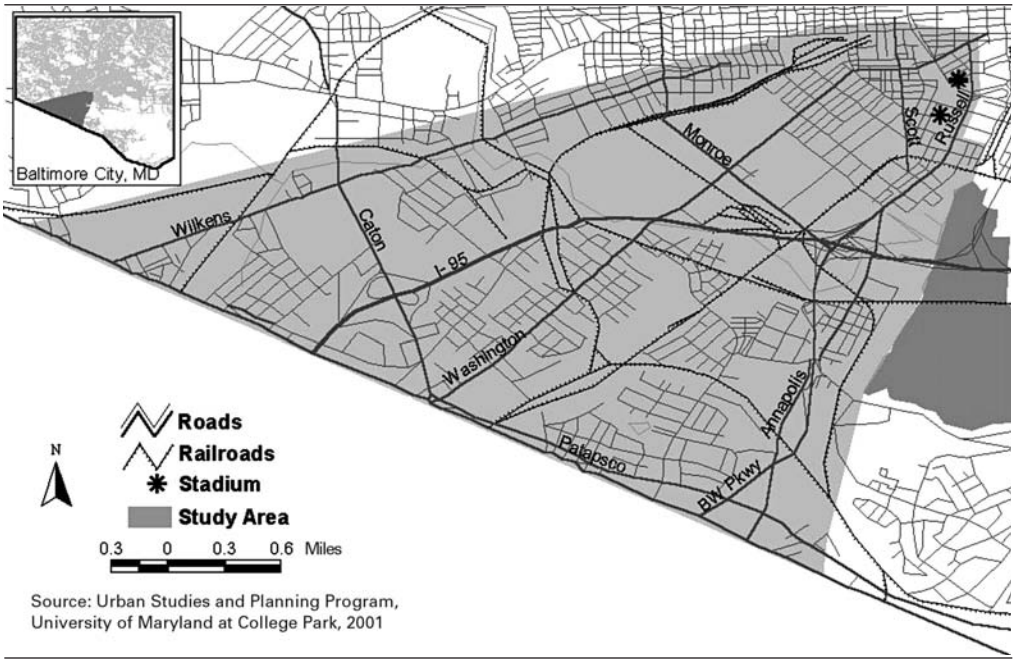
[4] The previous study by Howland (2000) surveyed all property owners in the Canton Industrial area over a 2.5-year period. That study, therefore, could identify the time a parcel was on the market before sale and cases in which parcels were put on the market and then withdrawn without a sale during 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.

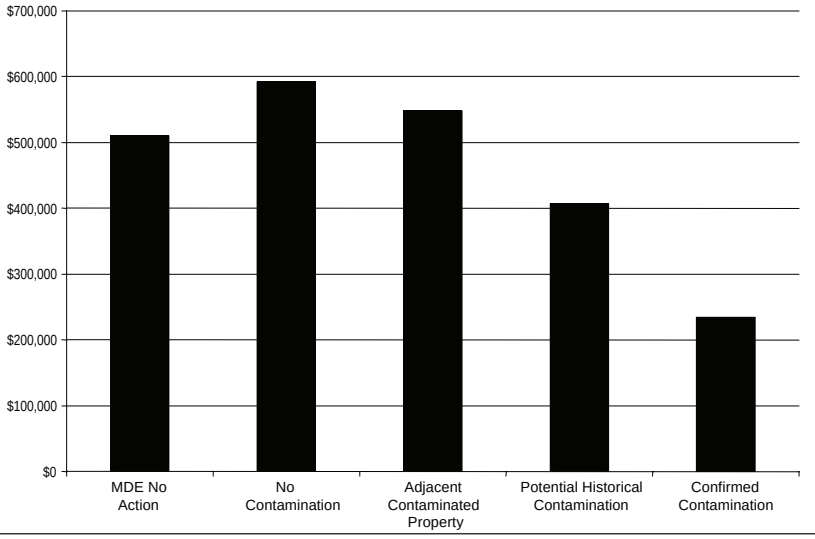
[11] Not reported here.

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.

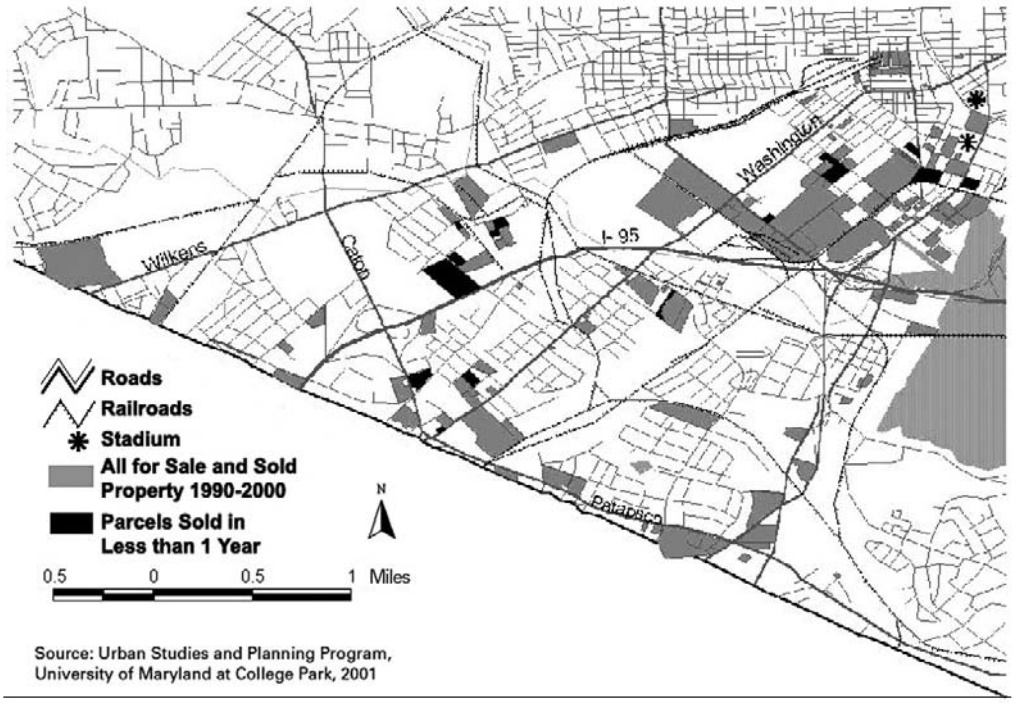
The comparison shows no indication that quick sellers and languishers are concentrated in specific locations. Exhibit 7, the quick sellers, and exhibit 8, the languishers, illustrate that both groups are spread over the whole industrial area.

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

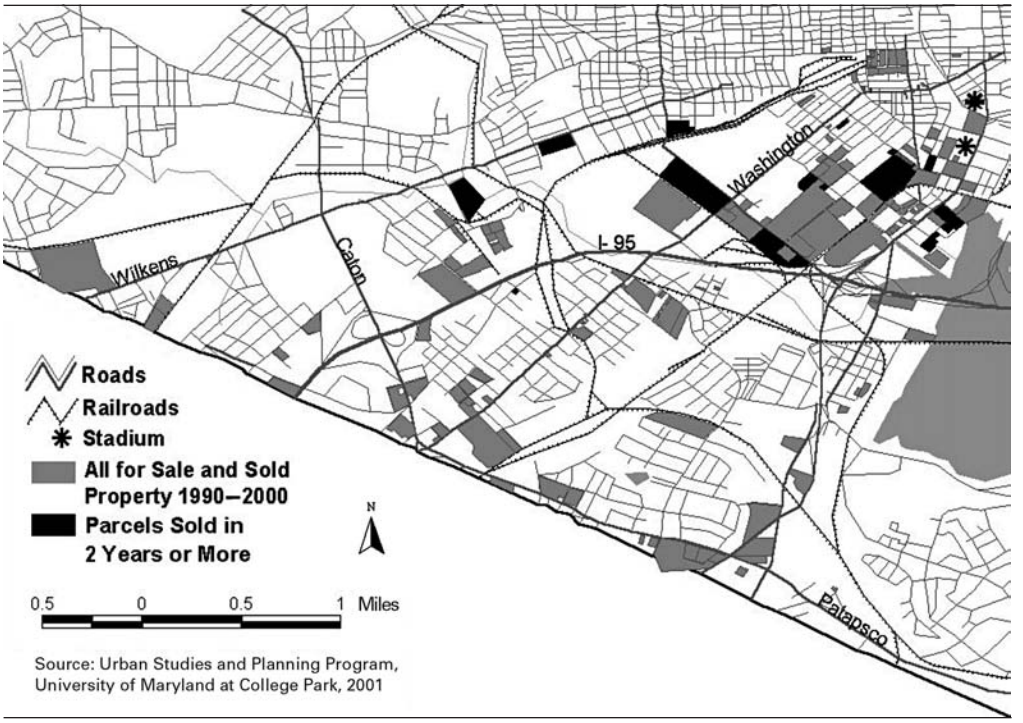
I conducted a series of extended interviews to determine which factors are barriers to property sale and industrial redevelopment. I interviewed the real estate agents or property owners of every parcel that had been on the market for 2 years or more or that was on the market and withdrawn without sale. 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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Brownfields, Risk-Based Corrective Action, and Local Communities

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Abstract

This article addresses the problems facing communities that suffer both environmental risks from past contamination and depressed economic activity. In such settings, redevelopment of contaminated sites and the associated economic development may require compromised standards for environmental mitigation. This potential conflict is often resolved through risk-based corrective action on sites cleaned only for their prospective use. But partial cleanups can be shown to face inevitable failure at some future date. Thus, in such an approach, communities face risks that they need to understand and should be capable of accepting or rejecting. The article considers these risks and assesses four alternative land use control strategies for assuring community participation in making decisions about both the cleanup process today and the response to risks of failure in the future.

Introduction

In 1980, the U.S. Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or the Superfund Act), which had a number of unexpected consequences. The act's draconian liability provisions improved general environmental conditions by raising the expected costs of future contamination to businesses and by discouraging the future use of toxins. The act's liability provisions, however, worsened environmental justice inequalities and undermined urban economic development prospects. CERCLA made urban regeneration in the United States more difficult and less likely to occur because of its clear public recognition of the environmental, and thus financial, risks posed by past pollution, regardless of cause or intent. CERCLA made urban land less competitive as a site for real estate investment relative to greenfield sprawl alternatives. As a result, all 50 states responded to CERCLA with new liability, cleanup, and development policies. The most immediate returns on remediation and redevelopment of brown-

field sites (those with real or perceived contamination), however, do not accrue to the states, but to local governments, which garner new tax revenues and may be able to remove tax-delinquent sites from their own property rolls (Meyer and VanLandingham, 2000).

Residents and property owners in local communities experience an inherent conflict between economic development and environmental protection objectives given that stronger environmental mitigation standards raise project costs and thus can slow the redevelopment process (Bullard, 2007). In considering communities' capacities to make rational and informed development choices, however, this article does not focus on the environmental justice issue that concerns Bullard and many others, but rather considers the generally limited capacity of community-based organizations of all types to address these brownfield tradeoffs effectively (Blair and Carroll, 2007; Leigh, 2000).

Although communities across the United States struggle to regenerate after economic declines produced by business closings and relocations, many confront land contamination issues that compound the problem of depressed property values. An issue of further concern, common to urban settings, is the clustering in an area of multiple nonadjacent contaminated parcels (scatter site brownfields) that undermine each other's economic attractiveness (Boyle and Kiel, 2001; Longo and Alberini, 2006). Such scattered brownfields pose special problems, but—ironically—they can provide a stimulus for organized, communitywide regeneration efforts: no one site can be addressed by itself in an economically efficient manner because the offsite effects of the environmental problems on nearby land would continue to pose exceptional investment risks. The interaction effects across the multiple scattered brownfields suggest a need for policymaking that transcends the developer's focus on a single project site and addresses the broader external effects on properties across communities.

The fact that a clear rationale for a collective community response exists, however, does not imply that it will be taken. The danger exists that a community-based response to economic distress may fail to address the full range of problematic exposures posed by the past contamination. One recently proposed agenda for community-led development, for example, mentions brownfields only in passing, although the agenda focuses on "America's older core cities" (Fox and Treuhaft, 2006). The real risk is that environmental problems associated with less costly site preparations may be overlooked in pursuit of short-term and purely economic returns, a risk that may increase with neighborhood or community desperation.

This article presents a review of some U.S. states' and municipalities' responses that avoid the sacrifice of environmental objectives to economic gains and suggests some lessons states and municipalities may learn from each other, once socioeconomic, political, and legal differences are taken into consideration. The discussion begins with a review of the real estate market and general economic conditions that shape the available financially viable remedial response options. Next, the article addresses risk factors that shape decisions and then discusses two major types of controls for environmental contaminants left in place. The article then considers the roles of time and project timing, examining first the role of the passage of time in emerging risks and then the issue of the time value of money in decisions about response costs to be incurred or expected. The article then examines the determinants of community roles in protecting local environments, explores how different patterns of land ownership affect the controls and risk management capacities of a project, and offers a brief conclusion.

Markets and Remedial Response Options

Even before property values declined from 2007 through 2009, U.S. real estate prices, in general, were not high enough to avoid the fundamental problem of mitigation costs that completely swamped land values on some brownfields. Urban sites that exhibited a land value that was lower than the cost to prepare the property for new construction were relatively common long before the 'credit crunch' and the market explosion of bankruptcies and foreclosures.

The relationship between clean property values and site mitigation costs, which determines the remedial responses contemplated, is shaped in large part by the continuous pattern of expansion of the urban fabric that is generically referred to as *sprawl*. To date, the United States has perceived itself as boundless, with automobile-based commuting permitting extremely low densities of settlement, resulting in the nation's urbanized area expanding more rapidly than its population for decades, even in regions with depressed economies. In these sprawling settings, the urban centers are quite literally hollowed out, leaving sections of total land and property abandonment. Detroit, Michigan is the archetype on some level, with multistory office towers sitting empty for decades—but other older industrial centers such as Cleveland, Ohio, have seen the phenomenon of a doubling of urbanized land area over a 20- to 30-year period of decline of total county or metropolitan area population.

This pattern of abandonment and the subsequent low market demand for land at the center of urban areas drove down property values, thereby severely limiting the extent of market-driven pollution removal projects at older contaminated urban sites. Contamination removal efforts in the United States have been driven by the intensity (and density) of intended new land uses, but even relatively high densities could not assure a financial capacity for complete removal of all contaminants, even when such a response was technologically possible (which is not always the case).

A new concern in the United States for "densification"—a market shift driven initially by demographic factors and now amplified by the increasing costs of automobile commuting —implies a more intense focus on economically viable reuse of centrally located urban lands. The renewed emphasis by the Obama administration on finding ways to reduce emissions and general energy consumption is another factor promoting increased population density and reuse of existing buildings because of the high energy costs associated with demolition and new construction. Any growth in the intensity of land use could drive higher property sales and rental revenues, which would render the more expensive and complete cleanup options cost effective.

A limit exists, however, to which these revenue gains can lead to complete mitigations of past pollution. The costs of remedial responses rise at a more than proportional rate with extent of removal or treatment of contaminants; it generally costs less to remove the first 10 percent of the pollution (near the surface, for instance) than the last 10 percent (that which is buried deeper or more broadly spread around). At some point, removing the next marginal unit of pollution from the site increases costs to a level at which the developer's current costs and revenues, not the project total costs over time, may drive contamination eradication decisions, because businesses cannot sustain long periods of negative cash flow.

Some costs associated with past contamination may be deferrable for long periods of time. Fully monitored contaminants that may be left on site, under regulations or special exceptions, are still

likely to generate future costs. But the timing of those costs—and the lack of certainty of their timing and dollar value—varies with the extent to which past pollution is remediated. That timing can also be affected by the different exposure risks posed by the variety of pollutants on a site, which is the subject of the next section.

Contaminants, Risk Factors, and Controls on Residual Pollutants

Three interacting factors shape the risks to human health and the environment associated with residual pollutants left on site:

1. The pollution itself (types and volumes or quantities of contaminants).
2. The damage done from exposure to different quantities of these substances.
3. The means of exposure (or pathways) by which humans and/or the larger ecosystem are impacted.

The more diverse the mix of *different* contaminants on a site, the more complex the toxic soup and the more difficult it becomes to determine the damage and exposure pathways. All three risk factors, however, need to be understood to be able to derive any probability estimates of the extent of damage under different conditions of contaminant retention for a site. Yet all risk-based corrective action (RBCA) responses assume that these probabilities not only can be known but that they actually are known.

The RBCA logic assumes that some preventive barriers or other management tools can be used on the existing contamination that can keep it from causing harm. The calculation is generally based on taking actions to ensure that key risks of harm lie below some threshold, such as injuries or death per million people exposed. The problem with this approach is that the probabilities generally cannot be known. Given the uncertainties involved, especially with mixes of contaminants on site, the data required for such risk calculations may be logically impossible to determine with any reliability.

The starting point to any risk calculation is to recognize that limiting human and ecosystem exposure is a key concern if a site contains contaminants. Perhaps that is why RBCA focuses on limiting factor (3) above through the implementation of specific controls to limit human and ecosystem exposure to contaminants left in place. That process of constraining the likelihood of damage relies on two forms of controls intended to limit the pathways along which risk exposures could occur. In the United States, these controls are referred to in RBCA policies as—

- ***Engineering controls* (ECs)—**physical barriers instituted to contain pollution and keep it from surfacing or migrating to eliminate (or constrain) exposure pathways.
- ***Land use controls or institutional controls* (LUCs or ICs)—**implemented to constrain onsite human activities to limit any possible damage to ECs and the total time on site for human exposure to whatever substances continue to move along partially blocked pathways.

Two points of inadequacy in this approach to controls should be immediately obvious from this description. First is the issue of ecosystem damage, which is overlooked by controls that relate only to human exposure limitations. Second is the assumption that the controls can be maintained over time, when the control specifications lack any discussion of the costs of maintaining those controls.

This latter point also reflects a failure to consider ecological interactions other than those involving humans: LUCs may constrain human digging to protect ECs, but they cannot control the behavior of pets, such as dogs, let alone the actions of rabbits, moles, or other wild animals that dig burrows for homes or foraging paths.

Both ECs and ICs limit the exposure pathways, but they do not fully eliminate them. In the event of failure of either ECs or LUCs, offsite neighborhood exposures can arise, with the resulting harm concentrated on those living, working, and owning property in the area, and the risk remains into the future (Rowan and Fridgen, 2003). Yet the real estate transactions underlying most regeneration efforts involve sellers, buyers, financial backers (including at times state or local government economic development agencies), and potentially one or more prospective end users, plus appropriate regulatory agencies, including financial and environmental regulators responsible for limiting aggregate risk. The site neighbors and their community, the parties most affected by the pollution risks—arguably those with the highest stake in assuring RBCA success—are rarely given legal standing in contaminated land site preparation and reuse decisions.

Time, Use, and Emerging Risks

Some current monetary costs can be avoided through a partial mitigation or by using a clean to intended use redevelopment strategy. There is, however, scant evidence that such approaches hold down total project costs over time. Strong logical and empirical grounds exist for claiming that RBCA failure is inevitable. Neither the engineering nor the land use controls currently available or installed in the past decade have been in place long enough to show that they will last the tests of time (Wernstedt et al., 2007).

The efficacy of ECs over time cannot be known, due both to limited past experience with the existing containment techniques and to an inability to forecast the future. The empirical finding that a barrier has lasted 10 years is not proof that it will last 20—or even 11—years. Consider the following:

- Accidental damage may result from actions of site visitors—or even by those of nominally informed occupants.
- Natural disasters—floods, windstorms, earthquakes, and the like may cause unexpected weakening of containments.
- Climate changes—in temperatures and humidity levels—can affect the viability of caps on pollution, such as those using clay and other natural impermeable layers.
- Some maintenance of barriers may be required and expected in plans (such as repairs of the surface of paved areas with asphalt or other such caps) but may eventually be ignored or forgotten over time.

ICs are even more vulnerable, because the limits on land uses and activities depend completely on the consistency and constancy of human behavior.

- Information on activity and use limits may be lost over the course of real estate ownership changes.
- Provisions for informing new owners are rarely codified, and even fewer regulations ensure that information about contamination is transmitted to future leaseholders and occupants.

- Informal occupancy changes and unauthorized site uses pose the risk of violating the preventive controls because such parties are likely to ignore any information that is available.
- The extent of this problem may vary, including across local authorities in those nations and states that delegate such regulatory enforcement to the local level.

Empirical evidence derived from U.S. environmental insurance market data reinforces the logical claims about the inevitability of RBCA failure over the longer term. Although pollution liability (PL) insurance policies covering a 20-year term were more readily available in 1999, by 2005 that market tightened terms to offering routine 5-year policies, with premiums on 10-year terms not just doubling but increasing to as much as four to five times what the shorter term coverage policies cost. Guaranteed renewals were available in 1999 but were not obtainable at any price in 2005, and underwriters were expressing a desire to push policy terms down toward the 1-year period, characteristic of U.S. homeowners and automobile insurance coverage terms. As might be expected from these findings, the overall supply of coverage—the total dollar limits of insurance available for PL policies—did not expand as quickly as the contaminated land market. Although the insurance companies do not report the total dollars of risk underwritten per product line, the availability of PL coverage may have decreased as demand increased (Yount, 1999; Yount and Meyer, 2005).

Insurers make money by underwriting risks. Their ability to do so is a function of their capacity to accurately predict losses and charge premiums for coverage appropriate to their level of claims. The tightening of term lengths in the PL policies available in the United States must be taken to reflect the insurers' inability to accurately predict claims and losses beyond a very limited period of time. The limited supply of PL insurance, in turn, may be read to reflect the overall lack of confidence of the insurance underwriters in their ability to develop better loss prediction algorithms in the future, and thus their reduced interest in maintaining a position in the PL insurance market. Thus, the insurers, on balance, reinforce the claim of inevitable RBCA failure through their market behaviors.

The Remedial Response Cost Issues

The inevitability of RBCA failure, in turn, poses questions for the private and public parties engaged in contaminated land redevelopment and area regeneration. These issues fall into the cost-benefit analysis framework and finally move the argument beyond simply monetary cost minimization for private real estate investors.

We can posit a constant level of benefits from site redevelopment and associated urban or community regeneration, provided that the project offers some minimum level of protection of human health and the environment. (Logically, then, the future costs of the remedy failure have to include the expense incurred in reproducing that minimum level of protection and compensation for any harm caused by the temporary lapse in protection.) Thus, we can consider how the probability of RBCA failure shapes three facets of decisions involving project costs and a policy principle regarding environmental cost allocation.

First is the issue of minimizing the present value of total project costs, which involves the timing of costs, with the total dependent on the time value of money. RBCA reduces current project costs, but inevitable future failure means that total project costs will include required future expenditures.

If the future costs of failure and repair are sufficiently high, the discount rate sufficiently low, and the failure costs occur soon enough, then the present value of total project costs could well be greater under RBCA than under a clean-to-background approach.

But a regeneration strategy cannot rely on the present-value cost as a basis for decisions on which sites to address and how to address the cost of cleanup if it is completely dependent on private capital investment. The issue of cash flow is central to private investors who face debt service or other financial obligations over time, typically sooner rather than later. The present-value-cost criterion thus leads to the issue of the distribution of costs. The extent of public responsibility for current costs is not clear if the policy objective is total-cost minimization over time. No question exists, however, about the logic of some public involvement if a criterion other than private internal rate of return maximization is to be applied to remediation decisions.

Once the public sector—and public interest—enters into the decision and the potential resource base for regeneration, then the decision process has to pose the question of the types of costs to include. Monetary costs are what matter most to private investors (and may be all that matters to them), so ecosystem and social costs may not be relevant to their decisions. But which monetary costs do they face? Which social costs are internalized into the investment decision and which are excluded? How are collective monetary costs (driven by air quality, water quality, and ecosystem health effects on human health status for people living or working in an area) addressed as distinct from individual costs (such as changes in housing costs and the cost to access amenities)?

The distribution of the cost burdens gets more complex when nonmonetized costs are added to the mix, especially when such elements are social or collective, making it generally impossible to internalize these elements into the investment decision. Yet knowledge of the distribution—and opinions about its efficacy and equity—are likely to affect willingness to pay. The resulting attitude will then shape the political will to invest the public funds that may be needed to complement private investment in regeneration projects. Policymakers' ability to exercise political will, moreover, may be constrained by a locality's ability to pay and fiscal stress.

This discussion excludes the politically sensitive question of the capacity of a coherent regeneration policy intended to minimize aggregate costs to humans and ecosystems to adhere to the "polluter pays" principle. RBCA approaches that reduce current costs to private investors can provide the aura of adherence to the principle. If, however, the future costs swamp the current costs, whether or not those eventual costs are discounted, the reality may be that the broader economy and society pay, not just the putative polluter. The problem is unavoidable without some form of indefinite insurance coverage when the polluter—or the regeneration investor benefiting from reduced current project cost under RBCA—is no longer in business or is economically incapable of paying for the inevitable costs of remedial response failure.

Community Roles in Local Public Cost Minimization

The geographic effects of any future RBCA failures, damages, and response costs are concentrated in the areas around the sites that still retain some pollutants. Yet, unless a conscious effort is made by a developer—or required by some public regulation—local community representatives are not involved in contamination management decisions associated with urban regeneration efforts.

An exception arises when a community-based organization (CBO) is itself a party to the real estate transaction. Neighborhood residents generally want to see eyesores, abandoned buildings, and environmental exposures removed and welcome new investment, especially in economic activities that provide even short-term (construction) jobs. New real estate investment, by and large, is in the interest of all neighborhood property owners, especially if the development removes the factors that contribute to depressed property values. If the regeneration effort brings new jobs for local residents, neighborhoods receive an even broader benefit. But the costs of those new revitalizing investments may be higher than is desired for long-term environmental risk exposures associated with RBCA site mitigations, and those higher costs present a tradeoff problem for the CBOs.

The apparent conflict between economic development and environmental protection costs is not new to debates in the economics literature. Many analysts have claimed that protecting the environment carries a substantial price by slowing rates of economic growth or by making current growth unsustainable (for example, Jorgensen and Wilcoxen, 1990; Rees, 2003). Others have argued that the conflict is exaggerated and the overall effect of environmental regulations on the economy is minimal (for example, Daly and Townsend, 1993; Jaffe et al., 1995). Yet others have acknowledged a potential problem, but demonstrated that the conflict could be avoided or muted through judicious choice of regulatory methods (for example, Carraro and Galeotti, 1997; Hahn, 1989; Pagiola, Bishop, and Landell-Mills, 2002).

The analyses in this debate over possible conflicts, however, are generally relevant only to economic aggregates such as states or nations. The tradeoffs in depressed communities (sometimes very small sections of localities) are much starker, because the effects involve location decisions internal to a larger economy. The presence of contaminated sites, from a market perspective, may not be the primary deterrent to new investment, given localized social problems, locational disadvantages, and other factors (Walker et al., 1998). The pressure to limit the stringency of cleanups in such areas is driven by an exceptionally high, immediate short-term need for jobs and income but is confounded by the unequal exposure to environmental risks (see Bullard, 2007).

Disregarding the specific tactics that might be pursued, basically just two options exist for CBOs and others confronting the dual problem of economic need and environmental risks when partial site remediations are proposed under RBCA standards. The first option is opposition and the second is acceptance, with some effort to monitor environmental conditions over time to ensure the ICs and ECs are not breached and the remedy is working and preserved as long as possible. Which response is preferred or adopted is likely to be a function of both the community and its organizational capacities and the specifics of the particular regenerative project, including factors such as the following:

- The size of the project and expected local effects, especially the positive and negative externalities expected by the community and residents in the short term.
- Previous property ownership and the new owners, occupants, or facility users, especially if the new owners are perceived as more community-rooted or locally involved than the previous ones.
- The legal disclosure or hearing requirements for new land uses, planning permissions, and the like, especially to the extent that they provide any reductions in uncertainty and perceived risk to the community.

- The extent to which some community is organized and recognized as having legal standing, and especially its experience in successfully influencing redevelopment projects and protecting local interests in the past.
- The extent of unanimity of community voice, especially regarding agreement on the tradeoffs between local environmental protection and economic opportunities.

Community Land Ownership and Potential Control

The likelihood that a community facing such a project sees resistance as its only possible response to an externally driven regeneration effort based on partial site mitigation will depend on the extent to which local residents and landowners can affect or control remediation decisions. That control, in turn, can be provided through community land ownership, an approach that may contribute to the economic—not just the political and social—viability of the redevelopment effort.

We briefly examine four means by which such control might be transferred in whole or in part to communities, giving them a means for exercising voice, a stake in remediation and regeneration, and a capacity for monitoring and protecting themselves over time:

1. Leaseholds.
2. Community shares.
3. Social housing trusts and associations.
4. Transfer of risk ownership.

Arguably, all these forms of land ownership or control could be exercised by a CBO, but a previous organization with a broader mandate need not exist. Single-purpose entities, or even the actions of individuals, not of community institutions, may suffice to provide means of control. We examine each in turn.

Leaseholds

The separation of the ownership of land from title to the buildings on the land is common in many countries but rare in the United States. A relatively new but growing U.S. institution, the Community Land Trust (CLT), has pioneered the use of retained title to land as a means of ensuring that low-income housing in high-value or rapidly growing real estate markets does not become inaccessible when households that bought the lower cost homes capitalize on their rising home values over time. Cities have begun to recognize the value of CLTs to their regeneration and low-cost housing provision efforts, and the model is expanding in the United States (Davis and Jacobus, 2008).

Separation of the landholder from the owner of the premises built on the surface provides the trust with a source of income from the rising property values to use in financing new low- and moderate-income housing. That is the organization's rationale for the land ownership. The trust's continued title holding, however, also offers the following benefits in terms of a capacity to manage risk-based corrective actions on contaminated land:

- It provides a party—the trust—with a long-term economic self-interest in preserving land value, which does not arise in freeholds with recurrent and unpredictable changes in title.

- The trust's stable, longer term interest and control can reassure other parties in the transaction that are concerned with project uncertainties, potentially leading to both lower cleanup demands from regulators and improved access to (and lowered costs of) redevelopment capital from lenders and other financiers.
- By holding and leasing the land, the trust lowers the current capital costs for developers (since they do not need to purchase the land) at the precise point at which reducing current expenditures is most important to project economic viability.
- These combined effects may promote site reclamation and redevelopment in property markets that would not otherwise support remediation costs.

Community Shares

Most regeneration efforts involve some sort of public-private partnership. The most common form of this relationship involves a public subsidy for a private investment that, presumably, would not otherwise occur. The subsidy is justified in terms of public benefits from the private project; however, those benefits are the effects experienced across the entire political aggregate providing or sponsoring the support. The immediate neighborhood of the project may not gain from the investment and may even lose, as in the case of gentrification.

This matter of divergent public interests has led to an effort to incorporate community benefit agreements into development plans using large public subsidies or special planning provisions (Baxamusa, 2008; Gross, 2005; Salkin, 2007). The benefits pursued tend to be focused on provision of jobs and housing for area residents, and, more broadly, some protection from the negative effects of rising local property values on low- and fixed-income residents, but they may include some environmental provisions, or at least access to decisions on remediation plans.

One spinoff from this concept (actually dating back to the idea of community development corporations (CDCs), originally conceived during the U.S. War on Poverty of the Johnson Administration in the 1960s) is the sale of community shares in the project, with associated voting rights and voice (Robinson, 2005). Shares are offered at unit costs affordable to local residents and—

- May be sold to residents, existing property owners, or others interested in the neighborhood (and often get sold to previous residents who have moved away).
- Can enable the articulation of interests in the community that are longer term than those of for-profit project investors.
- May be structured as special shares that do not participate in all investment risks or proceeds.
- May mimic leaseholds, with even minority interest holdings in the total land or project values.
- May, by providing a basis for articulating local interests and ongoing capacity for public disclosure of project decisions and activities, lower community resistance and thus ease the project development and approval process.

Social Housing Trusts and Associations

Although some housing and land trusts have recently emerged in the United States, Europe has a long tradition and a varied practice of social housing, well articulated in the form of what are known in Britain as "housing associations" (Ball, 2005). In the United States, these associations may be at-arms-length local housing agencies with municipal support or more independent local nonprofit agencies providing housing at below-market rates. Many are real estate subsidiaries of CDCs. Analogous to the land trusts, associations—

- Are long-term property holders.
- Act on behalf of their members and residents, and they, in turn have direct voting rights, generally as members of a cooperative, which gives them more direct involvement and access than in the case of a separate land trust as landowner.
- Have an interest in protecting against contamination risks on behalf of the residents, as members with economic and human health concerns.
- Must maintain their financial viability and borrowing capacity over time and, thus, must protect the integrity and market value of their assets.
- Have the capacity and motivation to control environmental response decisions in reclamation and regeneration.

Transfer of Risk Ownership

In the context of the in-perpetuity liability risk that CERCLA imposed in the United States, a market has developed for parties willing to accept those low-probability but high-cost risks for extended periods of time (Calland, 2008; McCartney, 2008). A party with some or all responsibility for past contamination on a site can pay a fee to another organization that will accept the transfer of that legal obligation. In effect, the ownership of the risk, along with funds to manage the risk and to insure against remaining uncertainties, is transferred to a new party by the originally responsible party, that can then walk away from the problem (Wernstedt et al., 2006). This transfer creates a new legal interest in the site, that of the risk accepter, and that interest then—

- Generates a long-term interest by the new risk owner—an interest that, by legal design, does not dissipate or decline with the sale, change of occupancy, or new use of the property itself.
- Provides legal recourse and a new responsible party that can be held accountable by current and future property owners, community members, and site residents or occupants, provided the identity of the new responsible party is made known (which should be an element of the risk transfer agreement).
- Adds the cost of paying for the liability transfer to the initial project costs, requiring more upfront capitalization than would be required without the risk transfer.
- Remains vulnerable in the future to uncontrollable (and offsite) changes in the economic or financial condition of the new risk owner and its insurer(s).

In other words, even if the risk accepter is the local community and/or its agent, this fourth approach to providing for long-term stewardship of an RBCA site may remain inferior to the preceding options, if only because of its cost. The purer market solution, in this case, appears to be inferior when viewed from the community's perspective.

Neighborhood Power: The Value of True Devolution

The fourth option above is inferior to the three preceding it, in part, because it does not fully take advantage of the benefits from neighborhood power by not really devolving the control to the local level. We can summarize the derivation of this conclusion in the following simple logical progression:

1. Stewardship is needed over time for all sites that are cleaned for use and leave some contaminants in place.
2. Legally available ownership forms will vary across jurisdictions, but options always exist for providing some form of ownership shares and associated interests to residents and others with long-term stakes in the area, and thus the site.
3. Eyes on the ground are always needed to monitor ongoing and changing land uses and to identify activities or events than might threaten engineered controls, and to spot evidence of control failures.
4. Such local eyes always have the most self-interest, in their roles as residents, occupants, or property owners, but these individuals may not have access to property management data and decisions (nor, at times, the knowledge to act on that type of information).
5. Local eyes in the form of interested individuals or organizations are not sufficient in themselves; they must also have the necessary organizational capacities to fulfill stewardship roles.
6. Community involvement, when the local eyes have both the access to information and the knowledge and institutional capacity to use it, can lower the costs of both the regeneration project and the needed stewardship, thus enabling both private developers and public redevelopment bodies to avoid expenses and risks they would otherwise have to incur.

Providing greater capacity for communities and community members to act is a logical approach to ensuring long-term stewardship for RBCA sites and monitoring of residual contamination of any clean-to-use regeneration project. This approach requires the state to provide at least some residents or their agents the legal standing required to take action through ownership, noted in item (2) above. Using the residents as stewards, however, also requires that their capacity to act coherently is assured through public provision of needed tools, as noted in items (4) and (5).

A clear need remains for a strong public role in contaminated land regeneration. First, the standards for site mitigation and control of contaminants need to be set at the national—if not transnational—level, where the application of scientific knowledge is not undermined by local economic desperation. Second, the tools for neighborhood action, as previously noted, need to be provided at the state or national level; the elected and appointed officials in many localities are likely to consider empowered community residents and organizations a threat to their powers, so requirements giving neighborhood representatives legal standing in RBCA decisionmaking processes will remain a necessity.

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Field Survey of HUD Site Contamination Policy

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Abstract

From 2000 through late 2009, the housing arm of the U.S. Department of Housing and Urban Development (HUD), Federal Housing Administration (FHA), recommended a "dig-to-clean" approach for contaminated sites rather than the risk-based corrective action (RBCA) approach favored by the U.S. Environmental Protection Agency and state Voluntary Cleanup Programs. Most offices followed FHA's dig-to-clean guidance and did not approve projects on brownfield sites. Some, however, tried to promote redevelopment of housing on brownfield sites by following RBCA. This article, based on a 2007 survey of HUD field office practice, discusses the issues encountered when field offices tried to resolve, on a case-by-case, project-level basis, the conflict between site contamination and brownfield redevelopment.

Introduction

In 2003, after almost 3 years during which the Federal Housing Administration's (FHA's) "dig-to-clean" policy differed from the U.S. Environmental Protection Agency's (EPA's) risk-based corrective action (RBCA) approach, the U.S. Department of Housing and Urban Development's (HUD's) Office of Policy Development and Research (PD&R) commissioned a study of HUD's Site Contamination Policy (HUD PD&R, 2003). Although HUD environmental regulations allowed for risk-based cleanups (24 CFR 50.3(i)(1)), chapter 9 of the *Multifamily Accelerated Processing (MAP) Guide* did not recommend FHA Multifamily Hubs[1] accept property for firm commitment where a site contamination problem had been "capped or paved over" (HUD Housing, 2002: Section 9.3E) nor to accept properties "with testing, flushing, or monitoring wells in operation" (HUD Housing, 2002: 9.3F). The EPA and state Voluntary Cleanup Programs (VCPs) favored a risk-based approach to corrective action that would allow the use of engineering barriers and institutional controls on brownfield sites. The 2003 study examined the difference between FHA and EPA policies and

[1] FHA Multifamily programs are administered by 18 Multifamily Hubs strategically located around the country.

recommended that "HUD Multifamily Housing should permit the use of risk-based methods, including institutional and engineering controls," and should also upgrade its risk-management capabilities (HUD PD&R, 2003: ES-1).

Until HUD revised the *MAP Guide* in late 2009 to allow for the RBCA approach to site cleanup, the dig-to-clean policy set forth in Section 9.3E of the *MAP Guide* was waived only on limited occasions and then with great caution. Because it was neither statutory nor regulatory, the Guide could be waived, but the burden would then be upon the FHA underwriter to clearly set forth in the record the reasoning behind each project-level waiver. The purpose of the 2007 study was to survey field practice and ascertain how HUD staff were coping with the challenge of promoting development in older urban areas with their high incidences of site contamination, given the fact that this dig-to-clean policy made it difficult for the housing arm of HUD to support brownfield redevelopment.

HUD has always been a heavyweight in the brownfield arena. Its flagship Community Development Block Grant (CDBG) program pumps about $4 billion dollars annually into local government projects to benefit low-income[2] and slum and blighted (typically brownfield)[3] areas. Fiscal year (FY) 2006 data, for instance, showed more than $331 million spent on property acquisition (including $7.4 million spent specifically on brownfield cleanup); $127 million on various economic development activities that included commercial/industrial rehab and construction, acquisition, and infrastructure; $70 million on housing construction; $127 million on Section 108 loan repayment; and $1.5 billion on public improvements.[4] It is reasonable to infer that much of this 2006 funding supported brownfield redevelopment. HUD funding for brownfield projects far exceeds that of other agencies, but HUD allocation decisions are made locally, when local governments divert a portion of their entitlement grants to specific brownfield projects, whereas EPA fund allocations are made at the federal level when funds are awarded to specific EPA brownfield program applications.

Housing is an important part of the brownfield equation; in today's post-industrial society, housing is often the highest and best use of the obsolete industrial buildings and/or undersized parcels that are near the central city. In mid-1999, the Northeast-Midwest Institute surveyed the states to determine the level of benefits they were enjoying through the redevelopment of brownfields. That survey confirmed what case examples and project anecdotes had suggested—that residential reuse of brownfields was an increasingly viable option in many communities. Although survey responses showed that only a few states track specific types of brownfield investments (such as housing), California reported that 5,200 new housing units had been developed on brownfield sites, Colorado attributed 2,855 new units to projects that gained approval through its VCP, and Michigan documented 1,400 new units at 11 different brownfield sites across the state (Bartsch and Dorfman, 2000).

[2] In general, 70 percent of CDBG must be spent in low-income areas (by census tracts)—areas where brownfields are often found—and, after paying for administration, the remaining funds may be spent on brownfield (slum and blighted) areas.

[3] 24 CFR 570 Subpart C—Eligible Activities was revised in 2006 (71 FR 30029) to clarify the eligibility of brownfield cleanup, development, or redevelopment within existing program eligibility categories.

[4] http://www.hud.gov/offices/cpd/communitydevelopment/budget/disbursementreports/.

FHA Multifamily programs have operated since the New Deal. The theory is that if FHA provides mortgage insurance to private sector lenders, these lenders are more likely to extend credit to meet rental market demand. The FHA insured loan is often the critical linchpin that holds complex, layered affordable housing financing together. One of FHA's goals is to "expand access to affordable private market housing" (OMB, 2005a). FHA has insured between $1.0 and $7.5 billion in multifamily mortgages every year since 1990, with a high of $7.5 billion in 2004, a low of $1.0 billion in 1991, and $3.73 billion (representing 70,914 dwelling units) in 2008, the latest full year reported (HUD Housing FHA, 2008). Although FHA underwrites only a small share of the rental market (OMB, 2005b), FHA market-rate rental units house a substantial number of low- and moderate-income people. In FY 2004, FHA approved 229 loans that also had Low-Income Housing Tax Credit (LIHTC) financing. Those loans represented approximately 29,400 units, with more than 25 percent of those units housing very low-income families. Many of the LIHTC projects also use other HUD programs, such as HOME, CDBG, and HOPE VI funds, in their financing structure. Many FHA projects have units that house tenants that are subsidized by the Section 8 rental housing assistance program (OMB, 2005d).

The restrictive dig-to-clean[5] housing policy set forth in the *MAP Guide* did not seem consistent with FHA's mission to support affordable housing, because it made it more difficult to find sites in older urban areas and/or to support the added cost of dig-to-clean cleanup. How did FHA conceive of this dig-to-clean policy that eliminates many previously developed sites from consideration for housing use? In the late 1970s, HUD quickly responded to the Love Canal crisis[6] by promulgating HUD Notice 79-33 before enactment of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or the Superfund law), in 1980. Notice 79-33 (1979), drafted before the subsequent CERCLA-Superfund framework had taken shape, called for HUD "to take consistent actions when responsibilities are shared by several agencies" and for HUD staff to examine "all pertinent material," reject sites that posed "serious health risks," and request that EPA review sites with "potential or possible exposure."[7] By the early 1990s, after more than a decade of the development of Superfund practice and not much substantive review of site contamination as part of its environmental review process, HUD's Office of Housing recognized that mortgage processing had to be modified to reflect the current reality where Phase I Environmental Site Assessments (ESAs) had become standard practice. In 1994, HUD Notice 94-88 required the sponsor to submit due diligence documentation and remediation before any HUD approval,[8] unless the project had received preapproval from the applicable government cleanup agency.[9] In 2000, this requirement was further modified when HUD issued the *MAP Guide* and included the dig-to-clean standard

[5] The phrase *dig to clean* is used in this report as shorthand for the MAP Section 9.3E requirement that "HUD will not accept property for firm commitment where a site contamination problem has been capped or paved over" (HUD Housing, 2002: Section 9.3).

[6] In 1978, when state and federal authorities declared a federal health emergency at the site of a former chemical landfill that had been redeveloped with a school and housing in Love Canal, New York, all federal agencies were asked to examine their procedures relative to site contamination.

[7] HUD Notice 79-33 (see appendix A in HUD PD&R, 2003).

[8] This requirement meant this cleanup was funded by sponsor equity.

[9] HUD Notice H 94-88 (see appendix A in HUD PD&R, 2003).

in its section on site contamination. By FY 2004, MAP lenders were underwriting 59.8 percent of basic FHA mortgage insurance applications (versus 32.2 percent in FY 2001) (OMB, 2005c). The *MAP Guide* instructed lenders to adhere to strict dig-to-clean standards by prohibiting the use of engineering barriers (no capping or paving over contamination) and monitoring wells. In addition, in 2003, HUD modified the processing instructions for the Section 202 Supportive Housing for the Elderly Program and the Section 811 Supportive Housing for Persons with Disabilities Program to require dig-to-clean treatment of contaminated sites.[10]

Although the early 1990s saw the birth of the brownfield program at EPA, it is important to remember that, at that time, the archetypal images were contaminated projects, such as Love Canal, that posed health risks. Transactional lawyers were also raising the legal possibility of EPA's stepping in to remove the contamination and then going to court with potentially responsible parties (PRPs) to be reimbursed for the cleanup. In a few high-profile cases,[11] lenders not only lost the value of their security[12] but also were held accountable for reimbursing cleanup costs as PRPs). Because HUD is a large organization involved in many real estate transactions, the Department was involved in cases in which it or its program participants were held liable.

Many HUD affordable housing programs use the worst sites—sites that no one else wants. HUD, as a federal agency, has a duty to ensure that minority and low-income residents are not disproportionately affected by redevelopment of contaminated sites.[13] In addition, when developing its site contamination policy, the Office of Housing saw its role as protecting not only potential residents but also the financial solvency of the FHA mortgage insurance fund. FHA takes pride in being a government program that pays for itself through sound analysis and mortgage insurance premiums. As long as the default rate stays low, everything is okay; HUD's endorsement of unacceptable risks would put the entire FHA mortgage insurance program in jeopardy.

With this perspective in mind, the Office of Housing crafted a policy that allowed HUD to approve brownfield sites that had been completely cleaned up (via the dig-to-clean approach) but not to approve sites where the problem had been capped or paved over. HUD's rationale was that, although FHA was designed to insure financial risks that the conventional market was unwilling to take ("…is there a market for multifamily housing at this unproven location?"), it was "not FHA's role to take environmental risks"[14] (Bonkoski, 2007). Conversely, some were concerned that this policy, more restrictive and conservative than the one favored by EPA, would make it difficult to support housing on brownfield sites, particularly at a time when brownfield redevelopment of mixed-use, walkable communities was being touted as the road to sustainability.

[10] See 2002 and 2003 processing instructions in appendix A in HUD PD&R (2003).

[11] For example, *United States* v. *Fleet Factors Corp.*, 901 F.2d 1550 (11th Cir. 1990).

[12] The value of the foreclosed property was lower after it was identified as a contaminated parcel.

[13] Executive Order 12898 of February 11, 1994, "Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations," commonly known as the Environmental Justice Executive Order.

[14] Interview (Bonkoski, 2007).

Issues

This survey of field office practice raised a number of significant issues relating to HUD field office participation in brownfield redevelopment.

Low Level of Awareness

In an e-mail survey, to which 89 percent of the FHA Multifamily Hubs responded, when asked to report about their experience with brownfield projects, including rejections, most (75 percent) had "nothing to report," even when brownfields were defined very broadly, as in the CERCLA (Superfund) definition:[15]

> The 2002 Brownfield Statute (PL 107-118) defines brownfield to mean real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

Several possible explanations for this response exist.

- Activity was taking place in fringe (undeveloped greenfield) areas. If most growth was taking place in fringe areas, then greenfields, with no site contamination, would not raise site contamination issues. In 2006, the FHA "Committee On Environmental Issues" (a subgroup of the Hub Directors) reported that some field offices, particularly those in the West, did not report site contamination as an issue that affected their day-to-day operations.
- Field offices did not recognize site contamination issues. Some offices reported "no brownfield projects," yet either reality checks with third parties, such as the state or EPA, or followup interviews, indicated that the office had processed brownfield projects. Every office in the followup oral interview had at least one brownfield encounter. Some offices thought that "brownfield" was an official state designation; others did not realize that a site that is not contaminated could be a brownfield because no one is willing to invest the time, energy, and funds to characterize its problems. In EPA's brownfield program, many sites have been freed for development after the EPA-funded site characterization identified either no or minor recognized environmental conditions (RECs).
- Brownfield projects were processed by state housing finance agencies (HFAs) through FHA's Risk Share program. If a state HFA performs environmental processing pursuant to 24 CFR 58 under the Risk-Sharing program, they are not subject to MAP guidance. During the reality check, it became evident that more than one brownfield project was processed by the state HFA.

Another way of explaining the responses to the survey is by relating them to one of the major findings of the HUD/PD&R 2003 study—that HUD has limited capacity and expertise to deal with site contamination problems. Many offices appeared not to recognize that they were dealing with brownfield sites and many did not make full use of their environmental staff to review and analyze those sites. Some offices took the state's approval as evidence that the site had been cleaned up to

[15] 42 U.S.C. 9601 (39)(A), Section 211(a).

HUD dig-to-clean standards.[16] Others were satisfied with environmental consultants reporting that any RECs had been removed and did not ask for the local (state VCP) approval.

Brownfield Policy Is Restricting Activity

Some jurisdictions have had difficulty meeting affordable housing needs in established urban areas when restrictive policies are followed (Bartsch, 2006). Currently, the FHA Multifamily programs represent a large portion of the affordable housing market. FHA plays an important part in the very complicated equation for layered affordable financing, because the principal lender often insists on FHA mortgage insurance of their funds. FHA-approved loans cannot use standard EPA RBCA procedures unless the Hub waives the MAP guidance or the state HFA processes the projects as a Risk Share. Ironically, some developers in several communities who originally intended to work with HUD on mixed-income housing developments at brownfield sites have been forced to develop all market-rate housing because of HUD's unwillingness to change its approach. Despite these barriers, initiatives across the country show that affordable housing projects can succeed at brownfield sites. In scores of cases, older contaminated sites have been converted into residential housing for senior citizens and low- and moderate-income families. Many of these projects come on the heels of market-rate developments, which also proves that the stigma can be overcome and that residents' comfort with institutional controls, such as covenants on the deed, can be achieved. Moreover, these projects have been accomplished in a way that makes economic sense and addresses environmental considerations appropriately (Bartsch, 2006).

The Brownfields Revitalization Act, which took effect in early 2002, has done much to address barriers to redeveloping contaminated property, including those sites being reused for housing purposes. From a procedural perspective, the law sets the stage for more innovative public-private redevelopment partnerships because it clarifies difficult liability issues that have deterred site acquisition and redevelopment. In addition, the law allows EPA brownfield grant recipients to use a portion of their site assessment or cleanup grants to pay insurance premiums that provide coverage (such as for cleanup cost overruns) for these sites. This flexibility helps prospective developers secure private financing by providing a better way to quantify and manage risk. In the past, this uncertainty has been a key deterrent to housing activities on brownfield sites.

Perhaps most importantly, the Brownfields Revitalization Act clarifies the state-federal relationship regarding cleanup, making it easier for developers to use innovative remediation technologies and engineering controls as part of a cleanup. Now, sites addressed by a state's VCP or response program are protected from EPA enforcement and cost-recovery actions. The only exceptions are sites where contamination has migrated across state lines or onto federal property; if releases of contaminants, or the threat of releases, present an imminent and substantial endangerment; if new information shows that a cleanup is no longer protective; or if a state requests federal intervention. States now will share $50 million in EPA brownfield program funding annually to support these response programs. In return, states will need to maintain a "public record of sites" addressed through their voluntary response program, and update that record annually (Bartsch, 2007).

[16] The HUD dig-to-clean standard would not have been achieved if the cleanup were RBCA based.

Field reaction to the effect of the MAP and Sections 202/811 Notice of Funding Availability (NOFA) dig-to-clean policy varied:

- **New York City**
  The New York Hub issued a policy paper on February 24, 2005, that asked for permission to implement a policy more friendly to brownfield reuse that included permitting the use of engineering controls. They noted that, in 2004, Section 202 applications had declined by 88 percent, from 25 to 4, and that the Hub had been returning funds for subsidized housing for elderly people and people with disabilities because it did not have any suitable (that is, clean) projects to fund.

- **Philadelphia**
  The Philadelphia Hub has worked with brownfield sites and even waived the MAP policy. Philadelphia has expressed concern that the limited (Section 202 and Section 811) resources are either not being used or are being channeled to suburban areas.

- **Chicago**
  The Chicago Hub has found that the MAP brownfield policy makes it difficult to keep up with the demand in those areas of Chicago undergoing redevelopment and, as a result, has waived MAP criteria and followed the EPA RBCA standard when possible.

- **Beyond MAP**
  The MAP guidance has created a regulatory environment that is hostile to reuse of brownfields. We found two sites with no RECs, apparently meeting MAP criteria, that had been rejected or subject to severe scrutiny because of the brownfield stigma.

Of the 18 FHA Multifamily Hubs, 5 (Philadelphia, Baltimore, Chicago, Columbus, and Minneapolis) waived this policy[17] for HUD mortgage insurance programs at the time of the survey, 1 (Boston) was considering waiving, and 2 (Jacksonville and Ft. Worth) were open to waiving.

Waiver of the MAP policy was needed in many cases for proposed FHA affordable housing brownfield projects to be financially viable, because project financing could not support complete removal of the contamination and government funding was limited. FHA's reluctance to participate in brownfield sites in which the cleanup had been approved locally made it more difficult to put together viable affordable housing projects in older urban areas, and this restrictive policy had a chilling effect on infill development (Schopp, 2003). FHA's limited participation in brownfield redevelopment, in turn, had a negative effect on environmental quality, because development in outlying areas is associated with adverse effects (RERC, 1974) and urban settlement is associated with lower generation of pollutants (CNT, 2009). HUD's original vision regarding site contamination called for HUD to "establish interagency and intergovernmental policies and procedures" and "to take consistent actions when responsibilities are shared by several agencies."[18] The FHA dig-to-clean policy was developed in a vacuum, and, when this study was performed in 2007,

[17] Waivers are permitted for multifamily mortgage insurance processed under MAP but are not permitted for the Section 202 and Section 811 programs that support housing for elderly people and people with disabilities.

[18] HUD Notice 79-33, paragraph 3, issued September 10, 1979.

little indicated that HUD Housing brownfield policy would undergo any significant change in the foreseeable future. Not only is policy revision a lengthy process, but staff also appeared reluctant (in 2007) to alter the policy.

Resistance To Altering Policy

The dig-to-clean policy was developed in the late 1990s. In the late 1970s, HUD's Office of Housing had established a practice of issuing more detailed guidance for the environmental assessment process than did the Office of Community Planning and Development (CPD) and the Office of Public and Indian Housing (PIH). The Office of Housing continued that practice when it issued HUD Housing Notice 94-88 on site contamination in 1994. Housing Notice 94-88 was the first HUD guidance that clearly called for the regular institutionalized use of the American Society for Testing and Materials (ASTM) ESAs (Phases I and II) in project analysis; it called for either cleaning up the site before project approval or gaining preapproval from "the applicable Federal, state, and/or local agency with jurisdiction."[19] In 2000, The *MAP Guide* expanded this guidance, as noted previously, by stating, "HUD will not accept property for firm commitment where a site contamination problem has been capped or paved over" (HUD Housing, 2002: Section 9.3E). The 2003 PD&R study (ICF Consulting, 2003) called for updating the policy to include using risk-based methods, approval before cleanup, upgrading HUD's analytic capabilities, and other measures to encourage brownfield redevelopment. HUD did not implement these recommendations until late 2009 (and it is still too early to ascertain the actual effects of these changes).

In the course of developing this report, HUD policymakers voiced many concerns, clearly implying that they believed the dig-to-clean policy worked and that it would not be wise to modify it.

Dual Standards

For nearly 10 years, the federal government had two standards: EPA's RBCA approach and FHA's dig-to-clean approach.

- Having two standards was confusing. When a developer asked his or her engineering firm what to do to clean up a site (that is, to make it fit for residential use), the engineers would usually answer based on generally accepted business practice, which was RBCA. State programs accommodated the RBCA approach that EPA favored. Many developers and environmental consultants were not aware that two federal agencies had two different approaches for cleaning up brownfield properties. What could happen?
    - Project planning could be based on one set of costs, and project feasibility would fall apart when FHA financing was needed, because more expensive cleanup would be required. This scenario could occur even if HUD CDBG funds were being used, because only FHA Multifamily followed the strict dig-to-clean approach (see exhibit 1).
    - FHA Hubs could be faced with difficult decisions when they request a dig-to-clean cleanup but receive an RBCA cleanup.

[19] Notice 94-88, 3. http://www.hud.gov/offices/adm/hudclips/notices/hsg/94hsgnotices.cfm.

Exhibit 1

Use of RBCA in HUD Programs Before 2010

HUD Office	Allows RBCA	Need Waiver[a]	RBCA Not Permitted
Housing (includes FHA)	Risk-Sharing mortgage insurance processed by state HFAs	Mortgage insurance processed by HUD	Section 202 (elderly people) and Section 811 (people with disabilities) subsidy programs
Public and Indian Housing	All programs		
Community Planning and Development	All programs		

FHA = Federal Housing Administration. HFAs = housing finance agencies. HUD = Department of Housing and Urban Development. RBCA = risk-based cleanup approach.

[a] *Some people think that this waiver must be approved by HUD Headquarters and not the Hub Director.*

- Each standard undermined the other.
  - The HUD standard provided a potentially unfair tool for future litigants. Some time in the future, a resident could allege that he or she is suffering ill effects from buried contamination and claim the developer was negligent. *Negligence* generally means culpable conduct that misses the legal standard (of a reasonable person) protecting individuals against foreseeable risky, harmful acts of other members of society. The key question is usually, "What is the standard of care?" If a developer processed his or her site through and received an approval from a state VCP, that approval would be evidence that the owner met the requisite standard of care. A separate more restrictive policy from the agency in charge of federal housing policy opens the door to alleging that the standard of care was not met.
  - EPA is the federal agency charged with protecting both the environment and the health and safety of this nation's inhabitants.[20] EPA has invested a great deal of time, effort, scientific study, and fieldwork to determine what standard is acceptable for residential cleanups. HUD adopted its policy with little coordination with EPA, and the 2003 HUD study recommended modification and adoption of the EPA approach. Continued use of a different policy undermined HUD's credibility in both lending and transaction support, which is why this 2007 study recommended dialog and cooperation between HUD and EPA on this issue.

Recommendations

Although the FHA dig-to-clean policy differed significantly from EPA policy, it was not an insurmountable barrier to brownfield participation by all local FHA offices for all but the subsidized Section 202 and Section 811 programs for elderly people and people with disabilities.[21]

[20] EPA's mission is to protect human health and the environment. Since 1970, EPA has been working for a cleaner, healthier environment for the American people. (See http://www.epa.gov/epahome/aboutepa.htm.)

[21] For Section 202 and Section 811, the NOFA criteria do not allow for deviation.

Decentralized case-by-case decisionmaking allowed many offices to approve brownfield projects.[22] The tools existed, but Hubs needed to be taught how to use them. After the Hub recognized that RBCA cleanup was a well-established, reputable choice,[23] the Hub was free to decide what best fit the needs of their local market. Hubs can be educated regarding what choices are open to them and trained to develop sensitivity on when and how to apply each choice.

HUD is always reluctant to erode its environmental standards. In today's post-industrial society, housing is often perceived as the best choice for land reuse. Many cities have a strong demand for housing near their centers and, given the right price (for example, subsidized substandard housing with lower rents), people will accept a location that might not survive a market test. HUD has striven to develop and implement standards that guarantee everyone, even the disadvantaged, a "decent home and suitable living environment."[24] Environmental justice demands we remain vigilant regarding what is acceptable, especially to those needing affordable housing and faced with more limited choice.[25] The strict site contamination policy has made it easier for Hubs to reject sites that local HUD decisionmakers felt were not viable projects. The September 2009 MAP revisions attempt to approach this issue with sensitivity so as not to upset this balance and to allow Hubs to reject contaminated sites when they think the risk is too great.

- **Policy Coordination**
  This report underlines the need for further dialogue and cooperation between HUD and EPA on site-contamination policy and practice. The original mandate of HUD Notice 79-33 called for close coordination of policy and practice with EPA. The 2003 report noted the subsequent divergence and called for HUD to bring its policy in line with EPA's. One federal standard would be less confusing to the public, state and local government, and the development communities. HUD would improve its capacity to review the technical merits of cleanup plans by using the state VCPs' expertise, insisting that projects be approved by the state VCP, and asking for technical assistance from EPA staff.

- **Processing and Training**
  Even though FHA has altered its policy, HUD staff still need to be better educated on the issues presented by brownfield redevelopment. Training may be provided to the field on various brownfield topics, including state VCPs and processing alternatives that may enable the use of

[22] FHA Hubs issue commitments for millions of dollars on new projects every day without HUD Headquarters' involvement. Hubs handle most of the issues that arise with the processing locally; they decide if the site locations are appropriate, and they know the market and make determinations about market, location, demand, and so on. Hubs know their geographic areas and what is being developed outside the HUD programs. They know that different kinds of brownfields exist and that a contaminated site in the middle of a neighborhood, which might have been providing housing for generations (public housing sites), are good locations for redeveloping and pose minimal risk to the government. Hubs also approve transfers of physical assets, rent increases, and partial release of security in some cases. Hubs go to court and represent HUD, enter into contracts, enter into Housing Assistance Payments contracts, take enforcement action against owners, and so on.

[23] RBCA cleanup was backed by those parts of the federal government that are responsible for protecting public health and the environment, such as EPA and the Centers for Disease Control and Prevention, Agency for Toxic Substance and Disease Registry.

[24] National Housing Act of 1949.

[25] Executive Order 12898 of February 11, 1994. "Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations," commonly known as the Environmental Justice Executive Order.

RBCA cleanups, as well as the environmental benefits of promoting mixed-use, walkable neighborhoods in efficient locations with access to jobs, shopping, and mass transit. This training will enable field offices to support brownfield development in those areas where they think it is appropriate. It should be clear to everyone that the regulatory standard for site contamination cannot be waived,[26] but that sites that come through state VCPs, even if they use engineering barriers and institutional controls, clearly meet this standard. Field offices should decide whether to participate in brownfield projects based on the factors such as marketability and long-term project viability. Judgment concerning public health is best left to those agencies with that expertise, just as judgment regarding project viability is best left to the local Hub.

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[26] The regulatory standard, is contained in 24 CFR 50.3(i) and provides, in part, "…all property proposed for use in HUD programs be free of hazardous materials, contamination, toxic chemicals and gasses, and radioactive substances, where a hazard could affect the health and safety of occupants or conflict with the intended utilization of the property."

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Brownfields Uncertainty: A Proposal To Reform Superfund

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Abstract

For decades Americans have been trying to reverse the momentum of urban decline. In an effort to ensure that abandoned, contaminated properties were cleaned up, Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, or CERCLA, also known as the Superfund Act. With the creation of the Superfund program, a liability scheme was put in place to make sure that brownfields would be cleaned up so they could be put into productive reuse. Unfortunately, the uncertainties associated with this liability framework have been declared by some to be the primary impediment to brownfield redevelopment. Private developers, who might otherwise provide the resources needed for redeveloping brownfields into vital community assets, are driven away from purchasing or investing in brownfield sites by the potential for catastrophic federal and state regulatory and tort liability. As a result, many brownfields continue to sit vacant or underutilized.

This article offers a solution to the risk and uncertainty resulting from federal and state cleanup and third-party tort liability often associated with brownfield sites, while preserving the current liability scheme as it pertains to parties actually responsible for the contamination. To mitigate the liability and tort concerns of potential brownfield redevelopers, this article proposes the creation of an absolute waiver of federal and state cleanup and third-party tort liability for truly innocent private parties that undertake to redevelop brownfield sites. Our proposed federal legislative reforms, coupled with incentives for states' participation, should serve as a catalyst for private-party brownfield redevelopment while strengthening the fiscal vitality of the Superfund program without reliance on taxpayer dollars.

Brownfield Redevelopment: Why Is It Important and Why Is It Not Happening?

If you drive around any city in the United States, it will not take long before an abandoned gas station, shuttered steel mill, or long-defunct factory comes into view. These often-polluted urban properties, the vacant and abandoned relics of America's industrial past, are commonly referred to as brownfields, and they are emblematic of the urban blight plaguing U.S. cities today. According to statute, a "brownfield site" is any "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant."[1] The U.S. Environmental Protection Agency (EPA) estimates that more than 450,000 brownfield sites currently exist in the United States, but other sources put the number at well over 1 million (EPA, 2010). Ranging in size from less than 1 acre to hundreds of acres, brownfield sites exist in cities and towns all over the country, where they drain local resources, waste vital urban space, and often provide a breeding ground for crime (see Eisen, 1996).

The label *brownfields* distinguishes these sites from their counterparts, *greenfields*, which are undeveloped suburban and rural parcels of land that real estate developers often prefer for their seemingly low development costs and freedom from environmental contamination and accompanying liability concerns. In actuality, the costs associated with the neglect of brownfields in favor of greenfield developments are quite high, but those costs are borne by the community as a whole rather than by individual developers. When the urban landform expands into greenfield sites, the resulting sprawl contributes to a litany of unwelcome consequences, such as increased vehicle miles traveled, which in turn leads to increased automobile emissions and longer commutes (Davis, 2002). Of even greater concern is the degradation of valuable ecological systems that provide essential service value to communities. The degradation results from lost farmland and open space when urban areas experience sprawl.

Throughout the past few decades, much attention has been focused on the importance of public policy in stemming the tide of urban sprawl. Much of this interest has manifested in the promotion of "livable communities" to attract people into urban centers and away from the periphery of the urban landform. Some localities have implemented policies designed to encourage more of a mixed-use, neighborhood feel to new urban developments, and others have included encouraging statements of intent in their comprehensive plans that suggest development be limited to designated growth areas (see, for example, U.S. Conference of Mayors, 2006; National Governor's Association, 2000). Unfortunately, brownfield sites continue to persist within the urban ring, and most efforts to reduce or prohibit further growth in rural greenfields have been ineffective.[2] Localities have relied on policies of persuasion and the enticement of the promise of livable urban neighborhoods rather than taking definitive steps to limit rural area development and to address obstacles to brownfield redevelopment.

[1] Small Business Liability Relief and Brownfields Revitalization Act, 42 U.S.C. § 9601(39)(A).

[2] The authors acknowledge that significant efforts and major investments have been made to reduce the number of brownfield sites, particularly by EPA and HUD, but it is our contention that, for the most part, these efforts have proved to be insufficient.

In response to several notorious hazardous waste catastrophes exposed in the 1970s, Congress passed comprehensive legislation designed to address growing public concern about the toxic legacy of our industrial past. The Resource Conservation and Recovery Act of 1976 (RCRA) provided a complex structure of cradle-to-grave rules governing the treatment, transportation, storage, and disposal of hazardous waste.[3] To provide further incentive for industry to comply with the mandates of RCRA and to address properties that became contaminated before the enactment of RCRA by imposing a comprehensive cleanup liability framework, Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), commonly known as the Superfund Act.[4] Although these hazardous waste statutes in tandem provide much needed incentive for industry to avoid contaminating our lands and are therefore remarkably effective in protecting Americans from exposure to hazardous waste, their liability provisions provide powerful disincentives for potential redevelopment of urban properties. In fact, many would argue that the threat of Superfund liability is the single greatest impediment to the redevelopment of brownfield sites (see, for example, Davis, 2002; Rubenstein, 1997; Anderson, 1996).

Scattered within and among some of the most commercially desirable urban centers in the country, brownfield sites are suspended in a sort of regulatory limbo; although not specifically designated as Superfund sites and listed by EPA on the National Priority List (NPL), they are nonetheless tarred by their potential—real or perceived—for costly environmental regulatory and third-party tort liability.

Uncertainty is the enemy of economic activity. Urban redevelopment activities are stymied in the face of uncertainty, and CERCLA liability represents great uncertainty. Before a developer will move forward with a project, he or she must be convinced that the effort will provide a favorable financial outcome. The potential for hazardous waste cleanup or third-party tort liability represents a significant uncertainty for a brownfields redeveloper. Because most development requires significant debt capital, and because lenders are notoriously risk adverse, it is no wonder that brownfield sites regularly fall victim to the uncertainties associated with CERCLA liability. Although many sites are only nominally contaminated, or indeed contamination free, the perceived stigma and uncertainty over regulatory and third-party tort liability attached to ownership of such sites keep otherwise desirable redevelopment opportunities off the market or off the radar of potential purchasers.

This article will attempt to offer a solution to what is possibly the most tenacious challenge facing brownfield redevelopment—the risk and uncertainty surrounding federal and state cleanup and third-party tort liability for private parties who wish to acquire and revitalize brownfield sites. This article proposes to mitigate the perils of brownfields redevelopment by allowing for an absolute waiver of federal and state regulatory and tort liability for truly innocent private parties that undertake to redevelop brownfield sites. The argument rests on the premise that the related objectives of (1) reducing barriers to urban redevelopment; (2) promoting livable, affordable urban housing; and (3) reducing the rate and intensity of rural and suburban greenfield development are normatively positive goals that ought to be vigorously pursued. This article focuses on the first objective: the reduction of barriers to urban redevelopment. It is important to recognize, however, that all

[3] 42 U.S.C. § 6901.

[4] 42 U.S.C. §§ 9601-9675.

three objectives are interconnected and indispensible to one another—facilitating one objective furthers them all.

Understanding Superfund Liability and Its Impact on Brownfields

RCRA was enacted to provide a structured approach to the private management of hazardous waste in an effort to ensure that such toxic byproducts of industry did not come into contact with people or sensitive ecological systems. Through CERCLA, however, EPA was given a mandate to respond to and ensure the cleanup of those properties that nevertheless have become the nation's worst hazardous waste sites. If a property has experienced a release of hazardous waste and is contaminated such that EPA determines that it must be cleaned up, the agency lists the site on the NPL and may then take action to ensure that the responsible parties clean it up. The "release" of hazardous substances includes the "spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment" of any hazardous material.[5] On the state level, many legislatures have given their state environmental protection agencies similar powers under state statutory versions of CERCLA. Although the particulars of hazardous waste cleanup legislation vary from state to state, many of the state cleanup liability provisions are similar to those of CERCLA.

When EPA begins a cleanup of hazardous waste pursuant to CERCLA, it endeavors to identify those parties potentially responsible for the release pursuant to CERCLA's liability provisions. These potentially responsible parties (PRPs) include the individual or corporate owners of contaminated property, both past and present. They can also include site operators and managers, tenants, investors, people who transported hazardous substances to the site, or any other party found to have created or contributed to a hazardous substance's release on the site. CERCLA gives EPA the authority to require PRPs to undertake a cleanup to protect human health and the environment. Alternatively, EPA can proceed to clean up the site itself and then order PRPs to reimburse the government for the response actions.

CERCLA imposes extraordinary liability, in the form of joint and several as well as strict liability on PRPs. If a PRP meets the statutory standard for responsibility, it is potentially responsible for the entire cleanup by itself. Because this liability is retroactive, developers who purchase the property after all contaminating activities have ceased can still be held responsible for cleanup costs. Further, potential liability is not a function of negligence on the part of the PRP. Not surprisingly, the liability provisions of CERCLA and similar state hazardous waste cleanup statutes have had a profound chilling effect on brownfield redevelopment efforts, owing to concerns that the redevelopment of these sites might expose the property owner to potentially limitless cleanup liability.

A core principle behind CERCLA's tough liability provisions is the notion that polluters should be responsible for cleaning up contaminated sites. With the enactment of CERCLA, this polluter pays principle was expressed in two ways. First, parties that caused the contamination were held liable

[5] 42 U.S.C. § 9601.

for its cleanup. Second, producers of chemicals and petroleum were required to pay a tax that was put into a special trust fund to be used to support cleanup efforts at sites where no financially viable PRP could be identified. During the early years of the Superfund program, this polluter tax provided a significant portion of the funds needed to clean up sites on the NPL. In 1995, however, the polluter tax on chemical and petroleum producers was allowed to expire and has not been subsequently renewed. As a result, the fund has effectively run out of money and thus the cost of continued cleanup for those sites where the PRPs are either gone or insolvent comes out of EPA's yearly appropriations, giving EPA even more incentive to pursue and obtain cleanup costs from PRPs.

With the threat of liability hanging over these properties, developers are reluctant to buy them, even at discounted rates, and risk-averse lenders are even more reluctant to fund such projects for fear of losing their collateral in the event of major environmental liability. The disincentives created by federal and state cleanup liability affect both municipalities and private industry. Cities are rendered powerless to curtail sprawling greenfield development because they cannot offer cost-effective urban alternatives. They are forced to watch their tax bases languish as urban properties sit unused and development flees to the countryside. The otherwise willing private sector, which would seem to favor developing brownfields due to their proximity to existing infrastructure such as access to utilities and transportation corridors, is kept from injecting needed capital into urban development because of uncertainty over harsh environmental cleanup and tort liability.

The Innocent-Purchaser Defense to CERCLA Liability: Is It Enough?

Since CERCLA was enacted, concerns about its chilling effect on brownfield redevelopment have resulted in numerous efforts to modify the statute and its implementation. Beginning with the Brownfields Action Agenda initiated in 1995, EPA and interested stakeholders have tried to compromise the liability provisions of CERCLA and reassure lenders and prospective purchasers of brownfield sites in the hope of stimulating urban revitalization. In an effort that has proven to be only nominally helpful, EPA identified sites that appeared in the Superfund program's CERCLIS database, but that had been evaluated by EPA and determined to be of no further federal interest, and placed them into an archive database in the hope this would destigmatize these sites.

Both Congress and EPA have recognized the impediment that CERCLA liability presents to brownfield redevelopment and have attempted to remedy the situation. In 1996, Congress passed the Asset Conservation, Lender Liability, and Deposit Insurance Protection Act (Lender Protection Act).[6] The act was meant to limit the liability of lenders who financed brownfield developments that were later foreclosed on. This amendment to CERCLA's liability structure fixed a problem that lenders had been having, wherein they were being held liable as PRPs under CERCLA for cleanups of properties that they did not actively manage, but which they became owners of by virtue of foreclosure. For those lenders who did not actively manage a contaminated property but merely held the property to protect their security interests, the Lender Protection Act amended CERCLA to exclude them from the statute's definition of owner or operator.

[6] 42 U.S.C. § 9601(a)(1).

Although the Lender Protection Act to some extent protects lenders from the grasp of Superfund liability, lenders can still find themselves suffering significant financial consequences. Lenders are still vulnerable to loss of value of the asset securing their loan and the uncertainties associated with the requirements of the Lender Protection Act. In addition, efforts have been made, both on the national and the state level, to attempt to mitigate liability for developers of brownfield sites who would not otherwise be liable for claims arising from the potentially hazardous condition of the properties. These efforts, however, have not proven to be effective enough to attract most redevelopment players into the brownfield market. More is still needed to ensure that private parties who voluntarily undertake to clean up and develop brownfield sites can achieve complete insulation from the uncertainties of cleanup and third-party tort liability.

Shortly after the enactment of CERCLA, the commercial real estate industry began to focus on a category of CERCLA defenses to liability based on the "act or omission of a third party" as a potential way to reduce liability uncertainty. The "innocent landowner" defense, which was enhanced through the Superfund Amendments and Reauthorization Act (SARA) of 1986,[7] granted liability relief to parties who could show that, prior to purchasing a contaminated property, they "did not know or have reason to know" that any hazardous substances had been or were being released on it. A property owner could show that he or she had "no reason to know" of the site's condition if he or she had conducted "all appropriate inquiries" into the history and condition of the property prior to purchase. This "all appropriate inquiries" (AAI) standard, although left undefined by SARA, became increasingly important in determining whether landowners could be considered PRPs in cleanup actions for contamination they had no part in causing. Tracking the statutory requirements of the innocent landowner defense, the commercial real estate industry collectively established a risk mitigation process known as a Phase I Environmental Site Assessment (Phase I), which was intended to satisfy the AAI requirement. The implementation of the Phase I assessment process was a great success, and within a few years of CERCLA's enactment, the industry had put in place institutional requirements for a Phase I on nearly every transaction in excess of $1 million.

Unfortunately, much of the uncertainty associated with cleanup liability remained. In an attempt to make access to the defense more effective, the commercial real estate industry joined forces with the emerging environmental consultant industry to create a standard definition for AAI through the American Society for Testing and Materials (ASTM). In 1993, ASTM published *E1527, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*. At its best, this standard provided consistency to what level of due diligence would qualify for a defense, but liability was not necessarily avoided and the uncertainty from CERCLA liability, as well as state cleanup liability and third-party tort liability, remained an impediment to brownfield redevelopment.

Congress again attempted to address some of this uncertainty with the passage of the Small Business Liability and Brownfields Revitalization Act (Brownfields Act) in 2002.[8] The act further clarified the standard of due diligence required for the innocent-purchaser defense, introduced the concept of the bona fide prospective purchaser (BFPP), and also clarified the situations in which liability applies to owners of properties contiguous to a Superfund site. The Brownfields

[7] 42 U.S.C. § 9601(35)(B)(i).

[8] 42 U.S.C. § 9601(40).

Act's clarification of these two important defenses, the innocent-prospective purchaser defense and the contiguous-property-holder defense, marks the most significant step yet toward eliminating liability barriers to brownfield redevelopment.

The contiguous-property-holder defense evolved, in part, out of a policy directive that EPA originally issued in June 1995. Recognizing the need to grant liability relief to property owners whose ground water became contaminated by hazardous substance releases on nearby properties, EPA issued a policy memorandum that stated that "subject to certain conditions, where hazardous substances have come to be located on or in a property solely as a result of subsurface migration in an aquifer from a source or sources outside the property, EPA will not take enforcement actions against the owner of such property" (Diamond, 1995). Property owners had to meet certain conditions to be eligible for contaminated-aquifer protection. They could not have caused or contributed to the release, been affiliated with or been in a direct or indirect contractual relationship with the party or parties responsible for the release, and could not be otherwise potentially liable for the release. In addition, EPA could, at its discretion, accept payment of a de minimis settlement from a contaminated-aquifer owner in exchange for a grant of immunity from third-party contribution.

The bona fide prospective-purchaser defense, perhaps the most important feature of the 2002 Brownfields Act, was an effort to clarify and expand the innocent-purchaser defense and encourage private parties to undertake brownfield redevelopment. Under the statute, as amended, if a party satisfies the following conditions, they are considered eligible for the prospective-purchaser defense:

- The property must have been purchased after January 11, 2002.
- The purchaser must show that all disposal of hazardous waste occurred before the purchaser acquired the property.
- The purchaser must undertake AAI into the site's "previous ownership and uses."
- The purchaser must provide "all legally required notices" of any future hazardous substance releases on the property.
- The purchaser must "exercise appropriate care with respect to hazardous substances found at the facility" by taking reasonable steps to "stop the release, prevent future releases, and limit exposure to released substances."
- The purchaser must not be "potentially liable, or affiliated with any other person that is potentially liable, for response costs at a facility." Affiliation, under the act, can be familial, contractual, financial, or corporate.[9]

The Brownfields Act officially mandated that EPA promulgate a rule to define the previously vague AAI standard within 2 years of the act's passage. Until such time as EPA issued its rulemaking, the Brownfields Act established that the 1997 revision of the ASTM E1527 would constitute the standard for AAIs. In 2005, EPA completed its rulemaking process, issuing Standards and Practices for All Appropriate Inquiries, 40 DFR Part 312 (November 2005) (the AAI Rule). Currently, this is the operative definition of AAI with respect to the innocent-purchaser defense under CERCLA.

[9] 42 U.S.C. § 9601(40).

Although it is a welcome clarification for potential brownfield redevelopers and their lenders, this standard is still difficult to satisfy, because it requires, as a condition precedent to establishing the innocent-purchaser defense, that the Phase I not contain any data gaps. Under the definitions set forth in the AAI Rule, it is often quite difficult to avoid having at least some data gaps.

The Unavailable Solution to the Problem of Uncertainty

Ideally, the developer of a hypothetical brownfield site would be able to reduce the uncertainty associated with CERCLA liability (as well as state cleanup liability) if, after performing a Phase I, the developer could ask EPA to review the report and then have the Agency issue a letter stating that the Phase I satisfies the AAI Rule and that the developer is not liable for any future cleanup costs attributable to prior activities at the site.

Similarly, if some level of contamination was discovered at the site, the developer might still be willing to remediate the site. In this case, the developer would want to ask EPA to review the final cleanup documentation to confirm that the site has been cleaned up to the satisfaction of the Agency, and that no liability for future cleanup remains. If the remediation is extensive, the developer would want to ask EPA to review the remediation work plan before performing the cleanup to ensure that it is appropriate and then ask EPA to perform oversight and review of the final documentation of the remediation, again establishing that no further liability exists.

Unfortunately, EPA is unable to provide these services to the private sector. One reason is that the review of these efforts would require significant staff time. Although the development community would be pleased to pay for that time, under current law EPA cannot accept payment, because it would be considered a supplemental appropriation. EPA would be required to remit the payments received to the Treasury, and the money would not be returned to EPA to cover the cost of the staff time. Further, no current mechanism exists through which EPA can routinely guarantee the developer that no further liability exists. In addition to concerns about federal cleanup liability, further uncertainty is associated with state cleanup mandates and third-party tort liability, and no available mechanisms exist to address these concerns.

A Proposal for Superfund Reauthorization

As previously discussed, the current Superfund regime suffers from two major problems. First, significant uncertainty—attributable to the liability provisions of CERCLA, state cleanup liability, and third-party tort liability—represents a major disincentive for urban redevelopment. Second, what is now known as the Superfund Trust Fund, which is used for remediating sites where no financially viable PRP exists, is chronically underfunded.

We propose that Congress reauthorize CERCLA in a manner designed to address these two concerns. First, the proposal aims to reduce and, in time, eliminate the cleanup liability risks that accompany voluntary, private-party brownfield redevelopment projects. Second, the proposal aims to provide a renewed and continuous flow of funding to the Superfund Trust Fund, which has been steadily diminishing since the suspension of the polluter tax. By making contributions to the fund volun-

tary and by spreading the responsibility for sustaining the fund to many more private actors, the proposal will ensure the continuing vitality of the Superfund Trust Fund, establishing a sustainable funding source for the nation's most serious Superfund cleanup responses.

The proposal consists of four elements:

1. Creating a new Superfund Trust Fund, called the Superfund Certification Trust Fund, to be managed by EPA for the purpose of receiving contributions from private parties to cover the staff needed to review Phase I's, cleanup work plans, and remediation closure documents on behalf of parties who wish to purchase and redevelop brownfield sites.

2. Authorizing EPA to issue a Certificate of Eligibility for Waiver of Liability to a party purchasing real property, upon request, based on a review by EPA of the satisfactorily completed Phase I and site cleanup, if necessary.

3. Authorizing EPA to issue a Waiver of Liability to a purchasing party who (a) acquires a Certificate of Eligibility for Waiver of Liability and (b) makes a small (de minimis) contribution to the original Superfund Trust Fund, now called the Superfund Cleanup Trust Fund. The Waiver of Liability grants immunity from federal CERCLA and third-party tort liability potentially arising from pre-existing hazardous environmental conditions on the site in question.

4. Delegating to state environmental agencies the authority to administer the new oversight and certification programs, subject to the condition precedent that states seeking delegation enact comprehensive legislation granting immunity from state regulatory and state third-party tort liability to holders of EPA-issued Waivers of Liability.

To illustrate how the proposal would work in practice, envision a hypothetical scenario in which a real estate developer is considering investing in a brownfield redevelopment project. The brownfield sits in an urban area with potential for growth and redevelopment. The developer wants to build a mixed-use residential and commercial complex on the site and estimates that the project would yield a reasonable return on investment, but for the cost of the uncertainties attributable to environmental liability. The site is a former industrial plant, which, based on its previous use, may be contaminated with hazardous waste, although no environmental site assessment has been completed for the site. The developer may be driven away by the environmental uncertainties, or, if not, may have limited access to development capital due to potential lenders' traditional intolerance of risk. The developer cannot purchase and redevelop the property while the risk of potentially ruinous environmental response and third-party tort liability hangs over his or her head. As a result, the property remains vacant and unused.

With the proposal's amendments to CERCLA in place, the developer's situation becomes much different. The developer begins the process by commissioning a Phase I, just as is done today. If the report reveals no indications of potential contamination, the developer submits the report to EPA, along with a request for review and a check for a predetermined amount, payable to the Superfund Certification Trust Fund.[10] EPA (or the state, if it has qualified for delegation of authority to

[10] We expect the price of the Certificate to be about $500, based on the anticipated cost of review time, including the reviewer's salary and associated overhead.

administer the program by adopting appropriate state legislation and requesting delegation from EPA) then reviews the report and determines if it satisfies the standards of the AAI Rule and reveals no indications of environmental concern. If the report is satisfactory, EPA then issues a Certificate of Eligibility for a Waiver of Liability.

It is possible that the developer will be satisfied with the Certificate; however, the developer's lender may require the developer to proceed to seek a Waiver of Liability for the site. This waiver would be automatically provided upon receipt of a predetermined contribution to the Superfund Cleanup Trust Fund.[11] The Waiver would be written in such a way that it protects the purchaser of the property and the purchaser's lender; however, it would not protect subsequent parties. The Waiver would be structured to exempt the developer from liability associated with any subsequently discovered contamination that occurred before his or her ownership, but the developer would be "kept on the hook" for any contamination that clearly occurs after he or she takes ownership. The developer must be kept on the hook to ensure that any intervening contamination events at the site are identified and, further, that the party in ownership of the property who was in a position to avoid this contamination event is now responsible for its cleanup. This provision would prevent the Waiver from becoming a license to allow subsequent contamination of the site. When a property subject to a Waiver is sold, the purchaser would need to go through the same process if they were to avail themselves of a Waiver, which would have the beneficial result of additional revenue for the Superfund Cleanup Trust Fund.

If the Phase I reveals a potential contamination issue, then the developer commissions a Phase II Environmental Site Assessment, seeking to determine if contamination exists. This assessment may result in a clean report or a report that recommends cleanup. A clean report would result in the issuance of a Certificate of Eligibility for a Waiver of Liability. If the report identifies the need for remediation activities, the property owner could pay EPA to review the proposed work plan and then review the documentation demonstrating the results of the cleanup activities. This way, the cleanup activities would be conducted subject to EPA review and, in some cases, oversight, which should result in greater uniformity of cleanup standards across the country and better assurance that work is performed correctly. In all cases, after the property owner has adequate documentation that the site is indeed clean, the site would earn a Certificate of Eligibility for a Waiver of Liability.

The Certificate of Eligibility for a Waiver of Liability would not in itself grant any immunity to the developer. In effect, it is a record establishing that the developer has met the requirements for BFPP status. If the developer stops the process here, the Certificate provides strong evidence to present in court that he or she has undertaken AAI, in the event that the developer must defend himself or herself against an EPA cleanup enforcement or contribution action. The developer, however, now has a further step he or she can take to ensure immunity. If, after receiving the Certificate, the developer makes a de minimis contribution to the Superfund Cleanup Trust Fund—in effect, a settlement with EPA to limit his or her liability for any future discovery of hazardous releases previously occurring on site—he or she would be granted a Waiver of Liability. The

[11] For a property valued at between $1 million and $10 million, we anticipate that the waiver will be priced between $10,000 and $20,000—significantly below the market value of the reduction of risk associated with the waiver (see, for example, Wernstedt et al., 2004).

Waiver would grant the developer immunity from cleanup and third-party tort liability arising from future response actions on the site, provided, of course, that the developer had no part in causing the hazardous release in question. In this way, the developer would be insulated from liability arising from any unanticipated hazardous conditions on the site, which he or she has had no part in creating and which he or she has made every reasonable effort to locate and clean up.

A key to the effectiveness of this process is the willingness of states to take on delegated authority to oversee site assessments and cleanups and to issue Certificates and Waivers. As a condition of having this authority delegated to state agencies, state legislatures would need to pass legislation giving the federal Waiver of Liability full force and effect on the state level and declaring that a Waiver of Liability relieves the holder of any potential state regulatory or third-party tort liability connected to environmental conditions on the site, as long as the holder is not otherwise responsible for creating such conditions. States would have an incentive to take on this oversight and certification authority because it would give them a role in the cleanup of brownfield sites and would generate jobs either in state government or in the private sector, because state agents or private contractors would be needed to perform the review, oversight, and processing of requests for Certificates and Waivers.

Evidence of Market Demand for CERCLA Liability Reform: The Price of Uncertainty

The proposal's success relies on a demand for increased certainty in the field of environmental liability for private parties. If the value of acquiring an official Waiver of Liability is less than the perceived cost of the risk, then developers and, more importantly, lenders will not take advantage of the changes in CERCLA's liability framework. Although further research is needed to establish exactly what price the market will put on the Waivers of Liability, existing research supports the existence of a general demand for such protection. In a 2004 discussion paper published by Resources for the Future, a Washington, D.C. think tank, Kris Wernstedt, Lauren Heberle, Anna Alberini, and Peter Meyer examine the relative interest to private developers of various public interventions to promote brownfield redevelopment. They conclude that, of a number of options offered to developers in a written survey, "relief from liability for future cleanup at the [brownfield] site" and "relief from liability claims by third parties such as site workers and adjacent land owners" are the most highly valued by developers in assessing the effect on a hypothetical brownfield redevelopment project (Wernstedt et al., 2004: 16–18).

The survey was sent to a sample of more than 300 real estate developers—some specialists in brownfield redevelopment, some generalists. They were asked to assess a hypothetical contaminated site where they would be building a residential complex. In addition to financial figures, such as "expected land purchase, investigation, remediation, and redevelopment costs and expected gross returns on the property," the survey offered "a number of different public interventions that developers could choose to improve their expected return on the site." The study estimated the relative value of different public incentives based on analysis of the respondents' choices. The results of the survey show that the value to developers of liability relief for future cleanups and third-party tort liability is significant. The average monetary value that the survey respondents placed on relief from future

cleanup liability risk was 3.1 percent of the project's total cost and 15.6 percent of expected profit. The average value that respondents placed on relief from future third-party liability risk was 4.1 percent of total project cost and 21.5 percent of profits (Wernstedt et al., 2004).

The message of the Wernstedt survey is clear: developers value and desire relief from liability risk in the context of brownfield redevelopment. In fact, they value it significantly. Applied to the expected costs and profits from the survey's hypothetical brownfield redevelopment project—the expected value of the project at completion was $30 million—the respondents' valuation of the immunity from cleanup liability risk (3.1 percent of cost and 15.6 percent of profit) was $702,000, and their valuation of the immunity from third-party tort liability risk (4.1 percent of cost and 21.5 percent of profit) was $969,000 (Wernstedt et al., 2004). These values are not insubstantial, and, although the survey offers just one estimate of the market's valuation of a hypothetical liability waiver, it provides a starting point and confirms the idea that the elimination of cleanup liability and third-party tort liability risk for developers will have a positive effect on their decisions to undertake brownfield projects.

Responding to Questions and Concerns

The elegance of the proposal is encapsulated in the idea that the only parties "let off the hook" under the new framework are those that are not "on the hook" currently and are not likely to allow themselves to get on the hook. Polluters currently liable for contamination would still be held responsible for all future cleanups just as they currently are, but voluntary private purchasers who did not cause the existing contamination but who want to redevelop brownfield sites would not be liable. The same people who are PRPs today will be PRPs tomorrow; however, innocent parties who wish to contribute to the revitalization of urban landscapes but are unwilling to do so in the face of current liability uncertainty would be able to proceed without concern.

The Waiver of Liability would apply only to hazardous releases occurring before the redeveloper's taking title. It would not exempt even a good-faith voluntary redeveloper from liability for contamination he or she creates or contributes to. Much like the current liability framework, parties who are in any way related to potential PRPs through business, familial, or contractual ties, would not be eligible for a Waiver of Liability. Furthermore, each new owner of the property would be required to obtain a new Certificate of Eligibility and Waiver of Liability, ensuring that the site is periodically reexamined and that contributions continue to flow to the Superfund Cleanup Trust Fund. The standards that private parties must satisfy in performing environmental due diligence and in remediating contaminated property would remain as they are today. Upon successful completion of these efforts, however, potential brownfield redevelopers would be able to reduce their uncertainty and obtain a Waiver of Liability pertaining to federal, state, and third-party tort liability.

Certificates of Eligibility need not vary significantly from current EPA standards for undertaking AAI. However, EPA would, in effect, waive the current data-gap exception in the AAI standard. It is unreasonable to expect private parties to be able to provide data for the site's entire history of use and ownership. Assuming a proper and thorough environmental site assessment is conducted according to EPA standards, unavoidable missing pieces in the site's history should not stymie the

granting of a Certificate, provided that reasonable efforts are made to fill in all data gaps. Again, the parties that would be absolved of liability in these instances are parties that would not otherwise subject themselves to the liability under the current Superfund regulatory regime.

A number of values would need to be established by the market for the new system to work properly. The amount that private developers would be required to contribute to the Superfund Cleanup Trust Fund in order to receive a Waiver of Liability would be significantly below the Waiver's market value but would need to be determined. Lenders, eager to minimize or eliminate the risk of their investment collateral being diminished in value by environmental liability, would be willing to discount interest rates for brownfield developers who can provide Waivers of Liability for their sites. The market would determine the value of this discounted rate. It is likely that lenders would require that developers obtain Waivers of Liability before financing brownfield redevelopment projects, much as they require a Phase I on all commercial real estate transactions greater than $1 million. The contribution to the Superfund Cleanup Trust Fund would in essence operate like a premium for a liability insurance policy that protects the owner and lender from the uncertainties of environmental liability.

Similarly, the revenue streams contributed annually to the Superfund Cleanup Trust Fund would be a function of the number and size of commercial real estate transactions made each year. It is expected, however, that these amounts would be significantly larger than the current level of appropriations allocated to Superfund cleanup actions, and the funding would, in effect, be entirely voluntary on the part of the contributors.

Essentially, this proposal provides potential redevelopers of brownfield sites a mechanism by which they can reduce or eliminate the uncertainties associated with environmental liability that currently operate as disincentives to such redevelopment activity. If the real estate industry can get EPA to absolve them of cleanup liability and third party tort liability, and that absolution is effective at both the federal and state level, a major increase in the redevelopment of brownfield sites should occur nationally. This increase is possible, however, only if the certainty of the Waiver of Liability is available.

The Waiver would function in a manner not unlike an insurance policy, which transfers risk away from the policyholder to another party. In this proposal, the Superfund Cleanup Trust Fund would become the recipient of the transferred risk, and the payment by the Waiver holder into that fund would be not unlike the payment of an insurance premium. The public would suffer no additional burden, because the parties obtaining Waivers are, for the most part, parties that would not have subjected themselves to liability without the Waiver, and thus would not have been PRPs. The public, however, would benefit greatly by increasing the opportunity for brownfield sites to be redeveloped.

By allowing the states to participate in the Waiver process, this proposal creates an incentive for states to enact legislation that would include state cleanup and third-party tort liability in the Waiver. State participation allows for devolution of the administrative implementation of the Waiver process, which reallocates some of the revenue streams associated with the Superfund Certification Trust Fund to the states, which in turn provides an opportunity for states to distribute their agency overhead costs across a larger universe of activities.

It is important to note that this proposal has many very specific dimensions that this article does not thoroughly address. Although many would say that the devil is always in the details, this proposal represents the framework for a significant solution to one of the greatest impediments to brownfield redevelopment. The authors plan to provide more details of this proposal in a future article.

Final Thoughts

Of perhaps the greatest importance for the cleanup of our nation's worst hazardous waste sites, this proposal is expected to provide significantly greater resources to the Superfund Cleanup Trust Fund than are currently available.[12] Much has been written about the cost of the Superfund program, in terms of money spent on cleanup activities by the government and PRPs, but the benefits of cleanup are also significant. Having a funding mechanism in place that provides possibly several billion dollars of funding for cleanup activities annually, without those funds coming from taxes, represents a good bargain for taxpayers, who are among the ultimate beneficiaries of the cleanup of these sites.

Another benefit of this proposed regulatory reform is that a larger number of private site-cleanup efforts will come under the scrutiny of EPA and the states. Under the current CERCLA approach, many private sector remediation efforts are undertaken without any government oversight, or they are done under state oversight with differing cleanup standards being applied, because state standards vary. With the proposed process in place, many more remediation efforts at brownfield sites will be done with EPA oversight and will be subject to uniform standards.

The uncertainty of environmental liability has served as a major impediment to urban revitalization efforts. These proposed reforms would remove this obstacle and serve as a major catalyst for brownfield redevelopment, taking development pressure off rural lands at the periphery of the urban landform, and thus reducing sprawl. The locational benefits of brownfield redevelopment are potentially enormous. Perhaps, most importantly, the preservation of rural ecosystems will be sustained as a result of this reform effort.

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[12] Based on data provided by CoreLogic, 135,774 commercial real estate purchase transactions, on average, occurred in the United States during each of the years 2005 through 2009. These data do not include multifamily residential properties with fewer than 10 units, and they do not include loan-refinancing transactions. If the price of the Waiver were to be $10,000 per Waiver, and if the commercial real estate industry were to routinely require a Waiver much as Phase I is currently required on nearly all transactions in excess of $1 million, the Superfund Cleanup Trust Fund would receive about $1.3 billion per year, *excluding loan refinancing and smaller multifamily transactions*. By comparison, fees generated by the polluter tax provided about $1.5 billion per year to the Fund until 1995, when the tax expired.

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The Prospects for Guiding Housing Choice Voucher Households to High-Opportunity Neighborhoods

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Abstract

The Housing Choice Voucher Program seeks to do more than help poor households lease good-quality rental housing. One of the program's goals is to help poor households break out of the cycle of poverty by locating in neighborhoods with numerous opportunities for gainful employment, good schools, and racial and ethnic integration. The Moving to Opportunity (MTO) for Fair Housing program showed that, with constrained choice, households will locate in low-poverty neighborhoods. If the MTO model were to be used on a larger scale, would enough neighborhoods be available to offer good housing, employment, and educational opportunities?

Examination of census block groups across the nation suggests that the supply of high-opportunity neighborhoods may not be as large as desired; there are simply too few ideal neighborhoods and affordable units. By relaxing the objectives, however, and focusing on poverty deconcentration and perhaps expanding the use of HUD's procedure that grants exception rents above the Fair Market Rent limits, a more ample supply of target neighborhoods and rental units could become available.

Introduction

One goal of housing mobility programs at the U.S. Department of Housing and Urban Development (HUD) is the deconcentration of poverty (HUD, 2008), which is valuable because it can reduce the high concentrations of poverty that create distress within the affected neighborhoods. As households are moved from areas with high-poverty concentration to areas of low concentration, benefits will hopefully accrue beyond the provision of affordable housing. These benefits include providing the households access to opportunities for better employment, education, and shopping in addition to higher quality housing in safer neighborhoods.

The Housing Choice Voucher (HCV) Program is designed to provide very low-income households with spatial mobility (Winnick, 1995). Sadly, the HCV Program has been unable to generate the spatial mobility that researchers and housing advocates hoped it would achieve (Devine et al., 2002; Goering et al., 1995). In general, although the recipients of vouchers use them to reduce the burden of housing costs, they have not used the vouchers to move to demonstrably better neighborhoods in proportion to the availability of affordable units and are, in fact, confronting increasing difficulties in gaining access to good neighborhoods (Varady and Walker, 2003).

If the HCV Program is going to improve the level of economic and racial integration in the nation's neighborhoods, program administrators need to explore mechanisms that will encourage, and perhaps even require, participating households to locate in neighborhoods that offer better opportunities than those that are found in the neighborhoods plagued by highly concentrated poverty. Several housing advocates and researchers have called for this approach. Polikoff (2004) specifically recommended that a Gautreaux-style program, which links acceptance of Gautreaux vouchers to movement to neighborhoods with low levels of racial minorities and other assisted households, be implemented at a national scale, with 50,000 vouchers earmarked for poverty deconcentration each year for a decade. Briggs and Turner (2006) outlined the logic of poverty deconcentration efforts that use vouchers. They suggested that the implementation and administration of the HCV Program be revised to pursue this goal. They proposed identifying high-opportunity neighborhoods to which voucher households would be guided, which may not be as easy as it appears. Briggs and Turner cautioned that we do not know a great deal about how to define "opportunity rich neighborhoods." They suggested that simple proxies measuring a neighborhood's racial composition or its incidence of poverty are incomplete. When identifying a high-opportunity neighborhood, researchers should assess the neighborhood's safety, the quality of its schools, and its access to jobs suitable to the assisted households.

Debate is growing around this concept of restricting the choice of any HCV household to just high-opportunity neighborhoods. Imbroscio (2008) challenged the use of vouchers to disperse poor households, calling it a misconceived version of freedom of choice. Goetz and Chapple (2010) avoided the normative issues and simply found that households that moved out of high-poverty areas, whether involuntarily or voluntarily, realized too few benefits.

Although the debate over the benefits of dispersal continues, the calls for a national poverty deconcentration effort raise the question: Are enough neighborhoods available to provide affordable housing in low-poverty, high-opportunity neighborhoods? This article attempts to answer this question.

Literature Review

The neighborhood outcomes of the HCV Program are unimpressive. The HCV Program does provide some opportunities for a household to move to low-poverty neighborhoods, and many households are able to locate in neighborhoods with modest levels of poverty, but many remain in neighborhoods with high concentrations of poverty. A study by Devine et al. (2002) of the 50 largest metropolitan markets in the nation found that more than 50 percent of participants in the HCV Program are living in neighborhoods with poverty concentrations of less than 20 percent, and close to 30 percent of participants are living in neighborhoods with a poverty rate below 10 percent. But

22 percent of HCV households live in neighborhoods with poverty levels at 30 percent or more. In central cities, more than one-third of HCV households live in neighborhoods with poverty rates at or above 30 percent.

In general, households participating in the HCV Program are free to choose the neighborhood in which they rent a unit. With only a few exceptions, the household chooses the location unencumbered by any programmatic constraints, and the issue of poverty deconcentration does not drive the process; however, the HCV Program is not completely without guidance in terms of the neighborhoods in which households locate. A relatively passive incentive guides HCV households to neighborhoods with greater opportunities. HUD uses a Section 8 Management Assessment Program to evaluate the administrative performance of the housing authorities that manage the HCV Program. The percentage of program participants who locate in neighborhoods with below-average levels of poverty is one criterion used to evaluate the housing authorities (HUD, 2007).

Previous Experience in Poverty Deconcentration

Two previous initiatives in poverty deconcentration—the Gautreaux and Moving to Opportunity (MTO) programs—provide instructive experience to the HCV Program's effort to move poor households to better neighborhoods.

Gautreaux was a quasi-experimental program born out of a court action taken against the Chicago Housing Authority and HUD. HUD gave vouchers and counseling assistance to a set of households on the condition that they move to neighborhoods with low levels of minority racial concentration. Households had to agree to move to census tracts with a minority population comprising less than 30 percent of the total (Keels et al., 2005). Given the high correlation between racial concentration and poverty concentration, the Gautreaux program was, in many ways, the initial foray into the use of housing vouchers as a method to relocate households out of impoverished neighborhoods and into racially and economically mixed neighborhoods.

The research on the Gautreaux program compares outcomes for participants who moved to predominantly White suburbs with those for participants who located in predominantly African-American neighborhoods in the inner city. Participant surveys indicate that those participants who moved to suburban locations were more likely to have a job than those who remained in the urban locations (with a differential of 13 percentage points), although they did not work more hours or earn higher wages (Rosenbaum, 1995). Survey results also indicate that the children of those who moved to the suburbs were more likely to stay in school, to be employed after graduation, and to go on to 4-year colleges or universities (Popkin et al., 2000).

Gautreaux spawned MTO, which is an experimental version of the voucher program (Goering, Feins, and Richardson, 2003). The MTO program gave vouchers to an experimental group who were constrained; to get the voucher, they had to move to a low-poverty neighborhood. Researchers compared this experimental group with a control group that received vouchers that did not limit where they could choose to live. The researchers found that dispersing impoverished households through housing programs may reduce the social problems that result from the concentration of this population, but our understanding of the linkages between neighborhood and life outcomes is very limited. Although incomplete, evidence is growing that neighborhood conditions influence

the outcomes a household will experience. Research reviews on this topic are found in Brooks-Gunn, Duncan, and Aber (1997); Ellen and Turner (1997, 2003); van Kempen (1997); Friedrichs (1998); Galster and Zoebel (1998); Leventhal and Brooks-Gunn (2003); and Sampson, Morenoff, and Gannon-Rowley (2002). Specifically addressing the MTO program and its movement of households to low-poverty neighborhoods, Goering and Feins (2003) collected studies from all five cities where the MTO program was implemented. Gains with the MTO program are found among children in terms of reduced criminal behavior, higher school performance (although more so for girls than boys), and improved mental health (Ludwig, Duncan, and Hirschfield, 2001; Ludwig, Ladd, and Duncan, 2001; Leventhal and Brooks-Gunn, 2003). Adults experience modest but statistically significant reductions in welfare usage, although these reductions may evaporate quickly (Ludwig, Duncan, and Pinkston, 2000). Overwhelmingly, the households experienced increased safety because the crime levels around them were reduced compared with those around the households that did not move to low-poverty areas (Orr et al., 2003). Unfortunately, the MTO program did not find significant improvements in employment levels (Leventhal and Brooks-Gunn, 2003).

Orr et al. (2003) summarized the MTO experiment, stating that the program had tangible positive effects on the lives of the participating households in terms of housing and neighborhood quality and the characteristics of the schools attended. They also stated, however, that they found no convincing evidence of gains in educational performance, employment, income, or self-sufficiency. They concluded that the poverty rate is an important neighborhood characteristic but that residential environments are multidimensional; no single measurement is able to capture all the attributes that are important to the lives of low-income families.

This research suggests that, when identifying opportunity neighborhoods, we must look beyond just the poverty level in the receiving neighborhood and that we should examine the potential for higher educational attainment, more safety from crime, and better opportunities for gainful employment.

Trends in Poverty Concentration

The number of neighborhoods with high concentrations of poverty actually decreased during the 1990s. The spatial concentration of poverty worsened during the 1980s, with Black households faring worse than White households (Kasarda, 1993). During the 1990s, this spatial concentration of those living in poverty lessened. By 2000, the number of census tracts with high poverty (greater than 40 percent) fell by 24 percent, affecting 2.5 million people (Jargowsky, 2003). This reduction in the number of high-poverty tracts has not meant that the number of low-poverty tracts has decreased. Rather, the number of low-poverty tracts (less than 10 percent) remained roughly constant while the number of tracts with moderate poverty (between 10 and 40 percent) increased (Galster, 2002; Kingsley and Pettit, 2003).

We will not know the spatial concentration of poverty for the first decade of this century until the American Community Survey begins to release those data at the tract level, and even these will be rolling averages that may take some time to stabilize. Overall poverty, however, has again risen to exceed the 1990 level. The percentage of the population that lives below poverty fell during the 1990s, from 13.1 to 12.4 percent (Census, 2002, 1992) but rose to 13.2 percent in 2008 (Census, 2009). This increase means that some neighborhoods with low levels of poverty in 2000 may have suffered from a rise in the incidence of poverty. An increase in poverty could move the neighbor-

hood out of the low-poverty category and into a different category suggesting that it should no longer be considered a high-opportunity neighborhood.

This changing level of poverty and its changing spatial concentration implies that the search for high-opportunity neighborhoods should examine more than just the most recent level of poverty in a neighborhood; it should also examine the changes in the level of poverty over time to prevent targeting a neighborhood as high opportunity when it is trending toward higher poverty.

Effect on Receiving Neighborhoods

Galster (2003, 2002) examined whether programs to relocate poor households result in a net social gain. He investigated alternative models and compared the social costs and benefits of deconcentrating poor households. He suggested that the conditions necessary to justify programs designed to deconcentrate poor households may be more stringent than are commonly understood. Proponents of spatial mobility often frame arguments only in terms of the benefits to the participating households, neglecting to consider the costs imposed on the receiving neighborhoods. For the relocation to lead to a net social gain, the gain from moving the low-income residents away from areas with high levels of poverty must be greater than the loss experienced by the receiving neighborhoods.

Some level of deconcentration of the moderate-poverty neighborhoods would be desirable, because they already suffer from above-average poverty. It is important that those identifying opportunity neighborhoods do not consider these moderate-poverty neighborhoods as destination neighborhoods expected to absorb additional impoverished households. Galster (2005) suggested that a net social gain can be generated only if the deconcentration results in fewer neighborhoods with high poverty, more neighborhoods with low poverty, and no additional neighborhoods with moderate poverty.

The implication of Galster's suggestion for identifying high-opportunity neighborhoods is that the process should examine not just the level of poverty in a neighborhood before an influx of assisted households, but it should monitor the effect that the in-moving assisted households will have on the level of poverty there. Any efforts to deconcentrate poverty should (1) reduce poverty in the high-poverty neighborhoods, (2) not increase poverty in the moderate-poverty neighborhoods, (3) move households to the low-poverty neighborhoods, and (4) not boost poverty in the receiving neighborhood in such a way that the neighborhood moves out of the low-poverty category (Galster, 2005). However, not all researchers are in agreement with this approach. Jargowsky (2005) suggested that the incremental harm to receiving neighborhoods with moderate-poverty may be relatively small and outweighed by the benefits realized by moving households out of high-poverty areas and into the moderate-poverty neighborhoods.

Categories of Poverty Concentration

Galster also suggested that a nonlinear relationship may exist between the level of poverty in a neighborhood and measures of neighborhood condition, such as property values. Much is unknown about this relationship, but limited evidence suggests that a set of thresholds exists (Brooks-Gunn, Duncan, and Aber, 1997; Friedrichs, 1998; Galster, 2005). The first threshold may be found when about 15 percent of the population is living below poverty. Below this threshold, the problems resulting from the concentration of poverty may not significantly affect neighborhood

condition. Above this threshold, the problems with increased poverty may rise significantly, with each added increment of poverty imposing costs on the neighborhood. The second threshold may be found when about 40 percent of the population is living below poverty. Above this threshold, the negative effects of concentrated poverty reach a maximum; increased poverty above this second threshold may have no additional negative effects.

The implication of the possible existence of a nonlinear relationship between poverty and neighborhood conditions for identifying high-opportunity neighborhoods is that the process should examine not just the level of poverty in a neighborhood but also whether the neighborhood is in the low-, moderate-, or high-poverty category and should target only low-poverty neighborhoods.

Housing Availability and Condition

Ultimately, the HCV Program is a housing program that uses the existing supply of rental dwellings. It can work only where rental housing units are available that can be leased within the regulatory constraints of the program. For the HCV Program to function property, the rental units must exist in the market and some of these units must be affordable; they must be offered at rents below the Fair Market Rent (FMR) limitations of the program. The FMR is the starting point for setting the maximum rent on a unit that can be admitted to the HCV Program. Public housing authorities have some discretion to set payment standards between 90 and 110 percent of the FMR. The payment standard dictates the maximum amount of subsidy that an individual household can receive through the HCV Program. Although this flexibility is permitted, the number of units with rents below the FMR is a rough indicator of how many units could participate in the HCV Program.

The implication of this administrative procedure for setting payment standards for identifying high-opportunity neighborhoods is that the process must examine the counts of rental units available with rents at or below the FMRs.

Presence of Other Assisted Housing

Any initiative that guides households to high-opportunity neighborhoods may need to consider the amount of assisted housing that already exists within the receiving neighborhood; too many assisted units or households may be harmful to the receiving neighborhood. Freeman and Botein (2002) reviewed the literature on the effect of project-based housing on surrounding neighborhoods. They found many flaws in past analyses and found conflicting results in the efforts to evaluate the perception that subsidized project-based housing results in negative neighborhood effects along dimensions such as property values, racial transition, poverty concentration, and crime. They found evidence that the effect can be positive, negative, or neutral. If a project removes a disamenity, such as a deteriorated building or vacant and litter-strewn site, the effect can be positive. If the project is poorly managed and fails to screen tenants, a negative effect can occur. Galster et al. (1999) extended this topic further into tenant-based housing assistance. They examined sales prices of single-family homes surrounding sites where Section 8 vouchers were being used in Baltimore County, Maryland. They found that if only a few voucher households were located within 500 feet of a property, this limited number had a strong, positive effect on property value in higher value tracts, with predominantly White populations, which enjoyed real value

appreciation. They found that in low- or moderate-value neighborhoods experiencing declining values, however, Section 8 voucher households have an adverse effect.

The implications of the effects of assisted housing on a neighborhood suggests that any effort to use vouchers for poverty deconcentration should guide participants away from vulnerable neighborhoods that already have high incidences of project-based units or tenant-based households.

Employment, Education, and Crime

High-opportunity neighborhoods should provide households with access to good jobs, access to good schools, neighborhoods that are free of crime, and good affordable housing. Although identification of these high-opportunity neighborhoods is easy in concept, it is harder in execution simply because of the limited data available. The Census Bureau publishes counts of workers in each neighborhood and indicates whether they are employed, but it does not publish counts of jobs in each neighborhood by skill level. The Census Bureau publishes counts of adults in each neighborhood categorized by their level of educational attainment, but it does not publish the counts of schools or any measure of their quality. Crime is known to be declining, but it remains an issue in many neighborhoods. Unfortunately, the Census Bureau does not publish any information on the level of crime. Sadly, no readily available, nationwide data sources exist at the census block group level on these three issues. Researchers will have to use proxies, such as low unemployment as a proxy for good job prospects and high rates of high school completion for high-quality educational opportunities.

Data at the Block Group Level

The data for this study come from census data tabulated at the block group level. For each block group, both 1990 Census and 2000 Census data were assembled. Those block groups that experienced boundary changes during the 1990s were reconciled through the use of data for all of the United States from GeoLytics, Inc. (2005).

In 2008, HUD provided household-level data for participants in the HCV Program, coded by block group location. The data were aggregated to the block group level for analysis. Only those households in the regular tenant-based voucher program were included in the analysis; those households in the homeownership, project-based voucher, enhanced vouchers, and the welfare-to-work subprograms were not included because they may have had different incentives and limitations on their ability to move to a rental unit in a location of their choice. Similarly, HUD made available counts of other forms of assisted housing at the block group level to assess the incidence of other assisted housing.

Block group data are a new unit of analysis for the study of poverty deconcentration. Most of the previous work was done at the tract level because the assisted household data were only available at that level. Now that the data are available at the block group level, however, the analysis will be improved. Block groups are smaller than tracts; each census tract contains about three block groups. This smaller size makes the unit closer to the generally held concept of a neighborhood (Coulton et al., 2001).

The Census Bureau has identified about 210,000 block groups nationwide (see exhibit 1). Each block group contains about 1,400 people divided among a little more than 500 households. These households live in 528 housing units, 187 of which are rental. Of the rental units, a little less than one-half are rented at prices that qualify them for the HCV Program, because they are offered at rents below the applicable FMR for the county where they are located. Nationwide, these units with rents below the FMR total 18.6 million units. Any of these units could be in the HCV Program. They are not concentrated in just a small proportion of the block groups. More than 98 percent of all block groups contain at least some rental units, and about 89 percent of all block groups contain at least some rental units offered below the FMR.

Exhibit 1

General Characteristics of Block Groups

	Median	Average	Total
Population	1,139	1,357	284,889,180
Households	430	509	106,741,426
Housing units	446	528	110,887,704
Rental housing units	118	187	38,707,899
Rental housing units offered below the FMR	43	90	18,575,689
Total count of block groups			209,876

FMR = Fair Marker Rent.

Source: U.S. Bureau of the Census, Census 2000

Analysis

Exhibit 2 begins the estimation of the number of high-opportunity neighborhoods by showing some very basic characteristics of the nation's block groups. Census data provide good counts of population and housing, but they provide only weak indicators of the potential for skill-appropriate employment opportunities for HCV households. Similarly, the census data indicate neither the quality of the schools nor the level of crime in a neighborhood. Because of the limitations of census data, proxies will have to be used. Unemployment is used as a proxy for job opportunities. The high school completion rate is used as a proxy for educational opportunities. Crime data are not readily available at the block group level, criminal activity must be assumed to correlate with the incidence of poverty. Although these variables are closely correlated, they do not always predict neighborhood distress accurately, nor do they always predict trends in neighborhood distress (Galster et al., 2003). They are, at best, proxies for the social forces at work, and as such introduce some level of measurement error into the analysis. Consequently, the results should be viewed with some caution.

Other characteristics of the populations living in block groups also display some spatial concentration. Within the typical block group, minorities account for about 31 percent of the population. Minorities are defined as anyone other than non-Hispanic Whites. Like those living in poverty, racial minorities are highly concentrated, with one-half of all neighborhoods containing less than 17 percent of minorities. In 2000, the average block group unemployment rate among all members of the workforce was 6.5 percent, but one-half of block groups enjoyed an unemployment rate under 5 percent. In the average block group, 21 percent of adults did not complete high school, but one-half of the block groups have about 18 percent that did not graduate.

Exhibit 2

Population Characteristics of Block Groups

	Median	Average	Standard Deviation
Percent of population below poverty, 2000	9.6	13.7	13.2
Percent change in poverty, 1990 to 2000	– 0.1	– 0.4	8.8
Percent of population minority	16.9	30.9	32.0
Percent of workforce unemployed	4.7	6.5	6.7
Percent of adults who did not complete high school	17.9	21.2	15.2

Source: U.S. Bureau of the Census, Census 2000

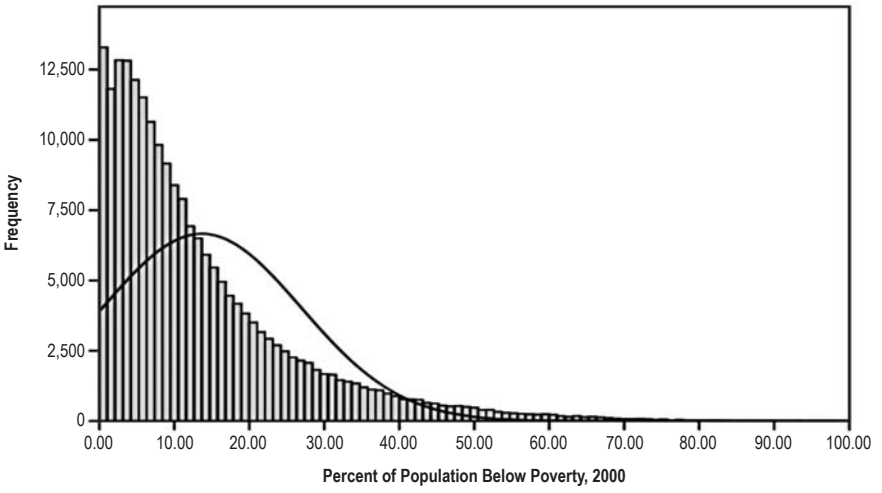
Distribution of Neighborhoods by Poverty Level

Deconcentration of poverty is an objective of the HCV Program. Typically, about 14 percent of a neighborhood's population lives below poverty. This group, however, is not distributed evenly. Rather, most neighborhoods tend to have a very low level of poverty.

In more than one-half of all block groups, less than 10 percent of the households live in poverty, which is below the lowest estimates of the threshold below which incremental increases in poverty have no damaging effects on the receiving neighborhood. The threshold of 10 percent is chosen here for two reasons. First, it is safely below the approximately 15-percent level that Galster identifies as the point at which a neighborhood is harmed by incremental increases in poverty. Using the 10-percent threshold should leave little concern that the neighborhood is threatened by the influx of low-income households. Second, using the 10-percent threshold is consistent with the MTO experiment. With one-half of all neighborhoods below this level, low-poverty neighborhoods are abundant. In addition, with the threshold at 10 percent, no problems will result from identifying a neighborhood as a low-poverty area when it is above median as would be that case with a threshold between 10 and 15 percent. (See exhibit 3.)

Exhibit 3

Distribution of Block Groups by Percent of Population Below Poverty in 2000, With Normal Curve Superimposed



At the other extreme, only about 1 in 20 block groups have very high poverty (that is, greater than 40 percent). About two-thirds of all block groups have below-average poverty, (that is, 13.5 percent). These statistics indicate that poverty is highly concentrated; about 4,100 block groups have poverty levels in excess of 50 percent, and another 5,500 block groups have poverty levels between 40 and 50 percent. The data show that 108,000 block groups with poverty levels below 10 percent can receive HCV households, probably without measurable harm. The remaining 90,000 block groups are the moderate-poverty neighborhoods (that is, poverty levels between 10 and 40 percent). (See exhibit 4.)

Exhibit 4

Distribution of Block Groups and Rental Units With Rents Below the FMR, by Level of Poverty in the Block Group

Level of Poverty in the Block Group	Block Groups	Percent	Rental Units Below the FMR	Percent
Less than 10%	108,175	52	5,214,971	28
10 to 19%	54,153	26	5,675,053	31
20 to 29%	23,728	11	3,550,024	19
30 to 39%	11,708	6	2,135,858	11
40 to 49%	5,542	3	1,101,222	6
50% or more	4,132	2	898,561	5
Total	207,438	100	18,575,689	100

FMR = Fair Market Rate.

Source: U.S. Bureau of the Census, Census 2000

Distribution of Rental Units Below the Fair Market Rent by Level of Poverty

As a point of departure for examining the feasibility of any poverty deconcentration program, it is important to look at the availability of rental units in the low-poverty neighborhoods targeted for receipt of HCV households, especially rental units offered at rents low enough for admission to the HCV program. About one-half of all block groups are in low-poverty areas, but only 28 percent of the rental units offered below the FMR are located in these neighborhoods. At the level of very crude arithmetic, the fact that only 28 percent of all rental units are available in high-opportunity neighborhoods is not prohibitive. More than 5 million rental units are offered at rents below the FMR in low-poverty neighborhoods. Those calling for greater poverty deconcentration efforts within the HCV Program do not seem to envision that more than a small portion of the HCV households would be involved in an initiative to move households to low-poverty areas. Polikoff (2004) suggests allocating 50,000 vouchers per year over a 10-year term to a poverty deconcentration initiative. Thus, even this ambitious effort would peak at 500,000 vouchers, which is only a small proportion of the available units in the marketplace.

Distribution of Assisted Housing Units

Exhibit 5 lists assisted households in the HCV Program and units in other federally funded project-based rental assistance programs. All programs listed in the exhibit suffer from some level of undercount. Some units or developments could not be assigned to a specific location because of reporting errors or other problems. Some projects simply did not report. This lack of reporting is

Exhibit 5

Assisted Rental Units and Voucher Households in All Block Groups

	Median	Average	Total
Count of Housing Choice Vouchers, 2008	3.0	10.3	2,165,998
Count of LIHTC units, 2006	0.0	6.7	1,402,999
Count of Public Housing units, 2008	0.0	5.3	1,118,427
Count of HUD Multifamily units, 2008	0.0	6.8	1,426,979
Count of all project-based units	0.0	18.8	3,948,405
Count of all assisted units	4.0	29.1	6,114,403

HUD = Department of Housing and Urban Development. LIHTC = low-income housing tax credit.

Sources: U.S. Bureau of the Census, Census 2000; U.S. Department of Housing and Urban Development, Office of Policy Development and Research

especially true for the Low-Income Housing Tax Credit (LIHTC) Program. States are not required to report all developments to HUD, thus generating the data set depends on voluntary participation in survey analysis. Through 2006, the portfolio of LIHTC developments contains about 1.4 million units, but it is believed that 1.6 million units were in place through that year. Although a difference of 200,000 units represents a sizable loss of data, the remaining data represent a very large sample, which provides a good indication of the location of these units.

The HCV Program serves about 2.2 million households.[1] The average block group has about 10 voucher households, but these households tend to concentrate in select neighborhoods. One-half of all block groups have three or fewer voucher households within their boundaries. In 2008, the HCV Program assisted very low-income renter households in about 147,000 block groups, or about 70 percent of all the block groups in the nation. Thus, about 63,000 block groups did not house any HCV households. Removing these 63,000 block groups with zero HCV households from consideration, the average presence of voucher households rises to about 15, with a median of only 6 units. This uneven distribution of voucher households means that in neighborhoods where voucher households are present, they typically lease well below 10 percent of the rental housing stock.

The distribution of project-based programs is understandably different from the voucher programs because the assistance is tied to a specific building. Project-based housing is concentrated in a subset of the nation's block groups. The typical block group contains no project-based units; thus, the median number of units in a block group is zero for all types of project-based units. The LIHTC program averages fewer than 7 units per block group, but the typical project contains about 50 units, and these developments are distributed across a little more than 17,000 block groups or only about 8 percent of the block groups nationwide. This concentration of LIHTC housing means that, where LIHTC developments are found, they comprise a significant share of the rental housing in the neighborhood, typically one-third to one-half of the rental housing in the block group. Public housing, with a portfolio of more than 1.1 million units, adds another 5 units per block group, but the

[1] For purposes of this study, only regular tenant-based vouchers are included in the analysis. Vouchers were excluded if they were used for homeownership, the Welfare-to-Work program, project-based housing, or the enhanced voucher program. Tenant-based vouchers account for more than 99 percent of all housing choice vouchers.

average public housing development contains about 50 units, although one-half contain 12 or fewer units. Similarly, where public housing is present, it is a significant share of the rental stock. Finally, the portfolio of HUD-assisted multifamily housing is subsidized under the Section 8 New Construction/Substantial Rehabilitation Program, the Section 236 Mortgage Assistance Program, and a variety of other vintage programs that no longer actively produce units. These programs have a combined portfolio of more than 1.4 million units. These HUD multifamily units add an average of about 7 units per block group, but they add more than 50 units to those neighborhoods where they are present.

Although all of these programs comprise only a small part of the rental housing market, it is important to examine the extent to which they facilitate the poverty deconcentration process.

The HCV Program is mandated to help poor households surmount the price barriers that prevent them from leasing good quality housing in decent neighborhoods. Exhibit 6 examines the extent to which HCV households are able to move into low-, moderate-, or high-poverty neighborhoods. The distribution of HCV households in each of the three categories of neighborhood poverty is roughly the same as the distribution of rental units offered at or below the FMR. The HCV Program is able to locate 27 percent of its households in low-poverty block groups. This rate closely corresponds to the 28 percent of the rental units with rents below the FMR. Similarly, 51 percent of all HCV households are found in moderate-poverty neighborhoods (block groups with poverty ranging from 10 to 30 percent), and this closely matches the 50 percent of the affordable rental housing stock found in these neighborhoods.

The data suggest that HCV households are very much dependent on the presence of affordable units, even though the households lease only a small portion of the available units. Whether in the low- or moderate-poverty block groups, HCV households lease between 11 and 12 percent of the available units offered below the FMR. Only in those neighborhoods where poverty afflicts more than 50 percent of the population does the incidence of HCV households decline to 8 percent. This decline suggests that the HCV Program is helping households to move away from areas with high concentrations of poverty and move to neighborhoods with lower levels of poverty.

Exhibit 6

Distribution of Housing Choice Vouchers in 2008 in Block Groups, by Poverty Category

Level of Poverty in the Block Group	Housing Choice Voucher Households	Percent	Rental Units Below the FMR	Percent
Less than 10%	589,023	27	5,214,971	28
10 to 19%	680,356	31	5,675,053	31
20 to 29%	434,377	20	3,550,024	19
30 to 39%	260,068	12	2,135,858	11
40 to 49%	126,556	6	1,101,222	6
50% or more	75,618	3	898,561	5
Total	2,165,998	100	18,575,689	100

FMR = Fair Market Rate.

Sources: U.S. Bureau of the Census, Census 2000; U.S. Department of Housing and Urban Development, Office of Policy Development and Research

Exhibit 7 describes the same issue for the project-based housing. While the variation is greater, the result is roughly the same: project-based units are distributed across neighborhoods categorized by poverty in proportion to the availability of affordable housing which, in nearly all cases, includes this project-based housing. (Note that in some block groups, the LIHTC units were added after the 2000 Census.) About 26 percent of project-based housing exists in low-poverty neighborhoods, which is close to the 28 percent of affordable housing that exists in these neighborhoods. Project-based housing is, however, heavily overrepresented in high-poverty neighborhoods. About 20 percent of all project-based housing exists in high-poverty neighborhoods (those with 40 percent or more poverty), but only 11 percent of affordable housing exists in these neighborhoods. These percentages indicate that this publically supported housing represents a disproportionate share of the rental stock in these distressed neighborhoods.

Examining the number of assisted units in a neighborhood is simple; determining the proper measure of market penetration by assisted housing units or voucher households is difficult.

Out of the 210,000 block groups nationwide, the incidence of assisted housing, either as project-based units or through vouchers, is very low.[2] More than one-half of all block groups contain only four or fewer assisted households or housing units, but distribution includes 50,000 block groups that have no voucher households or project-based units at all. Excluding those block groups with no assisted housing, the incidence of assisted housing remains low. Among those block groups with some assisted housing, about one-half have fewer than 10 assisted units, which is only 2.2 percent of the housing stock in these block groups.

Many issues are involved in determining the level at which assisted housing in a neighborhood is viewed as a threat. The literature is large (see Freeman and Botein, 2002, for a literature review); however, the bulk of this literature addresses the effect of project-based housing on the value of nearby properties. Little of this research addresses the effect of voucher households on receiving neighborhoods, but work by Galster et al. (2003) addresses the issue directly.

Exhibit 7

Distribution of Project-Based Housing in 2008 in Block Groups, by Poverty Category

Level of Poverty in the Block Group	Project-Based Assisted Units	Percent	Rental Units Below the FMR	Percent
Less than 10%	1,021,078	26	5,214,971	28
10 to 19%	983,681	25	5,675,053	31
20 to 29%	679,109	17	3,550,024	19
30 to 39%	499,664	13	2,135,858	11
40 to 49%	339,151	9	1,101,222	6
50% or more	425,505	11	898,561	5
Total	3,948,188	100	18,575,689	100

FMR = Fair Market Rate.

Sources: U.S. Bureau of the Census, Census 2000; U.S. Department of Housing and Urban Development, Office of Policy Development and Research

[2] The incidence of assisted housing may actually be lower because the calculation here adds the count of HCV households to the count of assisted units, but vouchers may occupy LIHTC units. Where this possibility exists, the count of assisted units is too high.

Galster et al. found that a few HCVs in a strong neighborhood can be beneficial if they are small in number (five or fewer within a 500-foot radius) and the neighborhood is strong (high market value and values that are appreciating). A 500-foot radius is not a big area: it is approximately 20 acres. A typical residential development contains four to five households per acre; thus, a 500-foot radius area would hold about 80 to 100 housing units. The typical block group holds about 500 units; thus, the area defined in the work by Galster et al. would be only a fraction of a block group, with five or six of these 20-acre areas in each block group. The implications of the work by Galster et al. is that 15 to 25 vouchers would be the maximum desirable in a block group with a strong market. These voucher households would need to be dispersed throughout the area, not concentrated within a single 20-acre area. Block groups typically contain about 500 housing units, suggesting that the maximum desirable percentage of HCV households is 3 to 5 percent.

This very crude arithmetic stretches the reach of the work by Galster and his colleagues. Despite the lack of precision inherent in such simple calculations, this figure can provide some guidance.

If the presence of HCV households is greater than 3 to 5 percent of all housing in neighborhoods with strong housing markets, it is likely to be detrimental to the neighborhood. For purposes of this research, the criterion will be that HCV households should be less than 4 percent of all housing in the neighborhood.

Similarly, a reasonable limit on the maximum number of assisted units desirable within a neighborhood may exist. The literature is silent on this issue. The debate has yet to be resolved on whether assisted housing affects the surrounding neighborhood positively, negatively, or not at all. Researchers may never undertake calibrating the effect as a function of the number of units, which is a more finely tuned issue. The typical block group with project-based housing, however, has a mean of 20 percent of all units assisted, but a median of only 8 percent. Using these rates as guides, it may be best that any poverty deconcentration initiative avoid neighborhoods where the incidence of project-based housing is more than 15 percent, both because this percentage represents a conservative level between the mean and the median and because it corresponds to the average level of poverty found in neighborhoods nationwide. HCV households should not be guided to neighborhoods where the presence of project-based assisted housing already creates a significant concentration of poor households.

A well-designed poverty deconcentration program should guide HCV households to desirable neighborhoods based on factors beyond just the presence of poverty and affordable housing. Again, how the criteria should be derived for distinguishing desirable neighborhoods from less desirable is not entirely clear. Most agree that desirable neighborhoods should provide opportunities for gainful employment, good schools, and racial integration. A cursory examination of measures of unemployment, educational attainment, and minority concentration could illustrate some criteria that could be used to identify desirable neighborhoods.

The analysis presented in this article assumes that low unemployment in a neighborhood is a good proxy for the availability of jobs in or close to that neighborhood. Neighborhoods with low unemployment are plentiful; more than one-half of all block groups experienced unemployment below 5 percent in 2000. (The national unemployment rate was 6.5 percent in that year.) Unfortunately, these low-unemployment neighborhoods appear to have smaller shares of rental units with rents

below the FMR than are found for block groups as whole. Those neighborhoods with unemployment below 5 percent contain only about one-third of the rental units with rents below the FMR. These percentages suggest that an HCV poverty deconcentration effort may confront problems if the criteria identifying high-opportunity neighborhoods become too ambitious. To succeed, the effort may have to permit households to enter rental units with rents above the FMR.

Another objective of poverty deconcentration is the movement of households, especially households with children, to areas with good schools. The census does not have a mechanism to tabulate school quality, but it does measure the educational attainment of the resident population of each neighborhood. It is assumed that this stands as a proxy for school quality. The measure used here is the percent of the adults who have completed high school. Housing units in areas with high educational attainment are distributed in a manner similar to housing in areas with low unemployment. About 42 percent of block groups have below average levels of high school completion (that is, under 15 percent); in 2000, about 21 percent of all adults had not completed high school. These block groups, however, contain only 28 percent of the rental units available below the FMR.

The level of minority concentration is the final issue regarding poverty deconcentration. Racial or ethnic minorities are defined here as all people except non-Hispanic Whites. Using this definition, the median minority presence is 17 percent among all neighborhoods. Given the high level of spatial concentration of minorities, the average presence, at 31 percent, is much higher. Developing categories is problematic because there is little theory to guide the process. When it comes to poverty concentration, some guiding theories suggest that if the distribution of poor households can be kept below a low threshold, such as 10 percent, that the effect on the neighborhood will be negligible. No comparable guiding theory for racial mixing exists. Evidence shows Whites have a lower tolerance for non-Whites than non-Whites do for Whites. This tolerance differential leads to an ideal level of integration for Whites that contains a lower percentage of minorities than the ideal level of integration among minorities (Farley, 1979).

In addition, minority concentration is subject to local conditions. In the Minneapolis-St. Paul area, all minorities make up 18 percent of the population, a figure close to the national average, but Blacks make up only 6 percent of the total area population compared with 13 percent of the nation's population. Hispanics comprise only 4 percent of the total compared with 15 percent of the national population. Similarly, in San Antonio, Blacks comprise only 6 percent of the population, but Hispanics comprise 53 percent. These data suggest that analysis of minority concentrations at the national scale must be viewed with some caution; the delineation of ideal levels of racial and ethnic integration are very different from one city to the next.

Exhibit 8 combines the many criteria that can be used to identify desirable neighborhoods. It begins with all block groups that contain all 39 million rental units in the nation, of which 18.6 million are offered at rents below the applicable FMR. The exhibit outlines the number of neighborhoods and rental units available as successive criteria are added to the definition of a high-opportunity neighborhood.

Beginning with all 210,000 block groups, this total is immediately reduced to 108,000 with the assumption that only block groups with poverty levels below 10 percent are desirable. Accepting only low-poverty neighborhoods as potential high-opportunity neighborhoods results in a loss of

Exhibit 8

Distribution of Rental Units With Rents Below the FMR and All Rental Units in Block Groups With Poverty Below 10 Percent and Cummulatively Adding Other Neighborhood Attributes

Poverty (%)	Project-Based Housing (%)	Housing Choice Vouchers (%)	Adults Not Completing High School (%)	Unemployed Workers (%)	Minority Population (%)	Growth in Poverty (%)	Block Group	Rental Units Below the FMR	Rental Units
All block groups							209,876	18,575,689	38,707,899
<10							108,175	5,214,971	14,655,207
<10	<15						103,190	4,896,221	13,865,507
<10	<15	<4					98,321	4,402,629	12,846,599
<10	<15	<4	<20				80,814	3,451,185	10,804,244
<10	<15	<4	<20	<5			63,085	2,573,679	8,269,921
<10	<15	<4	<20	<5	<20		50,090	1,739,372	5,493,402
<10	<15	<4	<20	<5	<20	<0	28,155	974,911	2,960,768

FMR = Fair Market Rent.

Note: R-square for the current formula is 0.787; 0.927 for the Administration's proposal.

48 percent of the neighborhoods. The loss of affordable rental units is even greater. The 18.6 million affordable rental units fall to only 5.2 million, a loss of 72 percent of the units offered below the FMR.

The order of adding additional constraints is somewhat arbitrary. Each new constraint causes a loss of neighborhoods and units. The order used in exhibit 8 simply adds constraints with the least potential to cause a loss of neighborhoods and units as indicated with the analysis of the distributions of assisted housing, educational attainment, unemployment, and minorities.

The first two constraints added involve the incidence of project-based housing and the presence of other HCV households. Guiding HCV households away from neighborhoods with above-average concentrations of project-based housing does not cause a great loss of either neighborhoods or units. Avoiding neighborhoods that already have a significant concentration of other HCV households also does not cause a great loss. If the high-opportunity neighborhoods have poverty levels below 10 percent, project-based housing below 15 percent of the total stock, and voucher households leasing no more than 4 percent of the housing, then 98,000 block groups remain with 4.4 million units.

Adding a constraint for low levels of adults who did not complete high school further reduces the number of neighborhoods and units. If the neighborhoods are also limited to just those where the failure to complete high school is less than 20 percent, then the available opportunity neighborhoods drop to 81,000 block groups and 3.5 million affordable units.

If we limit the available block groups to just those with unemployment below 5 percent in 2000, the count of available block groups falls to about 63,000 with 2.6 million affordable units.

Adding a constraint based on the presence of minorities has a significant effect. If the constraint calls for the presence of minorities to be less than 20 percent—a very modest level—then the

available neighborhoods drop to about 50,000 block groups (about 23 percent of the total) and the number of units to only about 1.7 million (only 14 percent of the total).

The last constraint is the trend in poverty, which is based on a decline in poverty during the 1990s, which was typical. This constraint, when added to the others, drops the available neighborhoods to only 28,000 and the available units to under 1.0 million.

It is difficult to know when the loss of neighborhoods and units becomes prohibitive, because it is hard to know how many neighborhoods and units need to exist to effectively implement a poverty deconcentration program. The HCV program as a whole assists more than 2.2 million households, but it is doubtful that a poverty deconcentration program would be applied across the entire program; too many households would not want to locate elsewhere. Even a modest effort, however, such as the proposal to engage 50,000 vouchers per year for 10 years, means that 500,000 units would need to be successfully leased in the designated high-opportunity neighborhoods. We do not know a great deal about the capacity of HCV households to compete against households without subsidies. We do know that HCV households are able to lease about 11 to 12 percent of the units in low-poverty neighborhoods. Perhaps this figure could be pushed higher, but it is doubtful that, short of a significant new incentive for landlords to participate in the HCV Program, the ability to capture units can be dramatically higher. If this is true, it suggests that a poverty deconcentration initiative should adopt not-too-stringent criteria for high-opportunity neighborhoods so that the participating households will be able to enter a large number of neighborhoods with more than enough units available.

What Has Not Been Examined

Several issues have not been explored that possibly should. The current analysis depends heavily on data available from the decennial census. These data may be sufficient, because several variables used in the census data correlate with other factors that should be used to develop an opportunity index. It is possible, however, that other data sets should be explored to see if they can provide measures that will improve the assessment of a neighborhood's potential to provide opportunities for good housing, employment, schools, shopping, and other services.

Conclusions

In an ideal setting, if enough neighborhoods enjoyed desirable traits (low poverty, high educational attainment, and full employment) and provided sufficient rental units priced below the applicable FMRs, it would be simple to guide HCV households to these neighborhoods. As a practical matter, however, too few neighborhoods offer all of these traits making the task very challenging.

Roughly 38 million rental units exist in the United States, but only about 50 percent of these units are listed below the FMR levels that govern the HCV Program. Thus, about 19 million units are eligible to participate in the program. Not all of these units, however, are located in desirable neighborhoods; many are located in neighborhoods that suffer from high poverty and unemployment.

If the HCV Program, or at least a significant share of its participating households, were to be restricted so that they could reside only in neighborhoods with poverty below 10 percent, only 5.2 million

rental units would be available. Although the 5.2 million units are greater in number than the approximately 2.2 million HCV households, this may not be enough, because the households in the HCV Program seeking eligible rental dwellings would have to compete with other unassisted renter households for these few units.

The HCV Program could restrict a program household to only those neighborhoods with the following characteristics:

- Low poverty (less than 10 percent of the population).
- Low presence of other assisted rental units (less than 15 percent project-based housing and 4 percent voucher households).
- Low incidence of adults who did not complete high school (less than 15 percent).
- Low incidence of unemployment (less than 5 percent).
- Low incidence of minorities (less than 20 percent).
- Declining poverty.

If these constraints were adopted, the number of affordable rental units would diminish considerably. Using 2000 Census counts, it is estimated that only 1.0 million rental units would be able to participate in only 28,000 block groups. This count of units is smaller than the number of households already in the HCV Program. In addition, units meeting these conditions are located in only 13 percent of the block groups across the nation, which would be a prohibitively small number of neighborhoods.

At present, HCV household are able to lease 11 to 12 percent of the affordable rental units in low-poverty neighborhoods (590,000 voucher households in the 5.2 million affordable units). If another 500,000 voucher households were added to this number, it would mean that HCV households would have to capture 21 percent of the available affordable units. It is unlikely that an influx of additional voucher households of this scale could successfully compete with unsubsidized households for units within a narrowly constrained set of neighborhoods. The voucher households would need to be able to search across many neighborhoods, not just a few. The need to search across many neighborhoods means that any effort to identify high-opportunity neighborhoods should exercise caution when adopting criteria that limit the location options of the participating households.

The households may also need to compete for units that are priced above the FMR. Units rented at or below the FMR make up just 28 percent of all the rental units in the low-poverty neighborhoods. This low percentage suggests that guiding households to low-poverty neighborhoods will be hindered by the requirement that units be rented at or below the FMR. Poverty deconcentration may be facilitated through the use of exception rents and other possible modifications to the HCV Program.

The analysis here is developed using only crude measures of the housing and demographic conditions in the block groups. Although this research is instructive because of its national scope, the results are only suggestive. It may be necessary to conduct more detailed research following the successes and failures of HCV households in metropolitan areas where the housing, employment, educational, and crime characteristics can be measured with greater precision.

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Measuring Neighborhood Quality With Survey Data: A Bayesian Approach

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The contents of this article are the views of the author and do not necessarily reflect the views or policies of the U.S. Department of Housing and Urban Development or the U.S. government.

Abstract

Although neighborhood quality is important for shaping public policy, it is also difficult to quantify. This study measured subjective neighborhood quality using data from two sources: (1) the 2002 American Housing Survey (AHS) and (2) the U.S. Department of Housing and Urban Development's (HUD's) Customer Satisfaction Survey (CSS) of Section 8 Housing Choice Voucher Program (HCVP) households. Survey responses were analyzed regarding neighborhood quality, home quality, and crime perceptions. Tract-level Bayesian estimates were computed using AHS metropolitan-level data and CSS census tract data.

The new Bayesian estimates have fewer outliers than the original CSS data, and the use of prior information allows for estimation for tracts with lower sample sizes than would be practical to estimate using only CSS data.

I compared the CSS and Bayesian estimates with other measures of neighborhood quality, such as poverty rates, median income, and indicators for tracts receiving low-income housing tax credits. The CSS and Bayesian indicators are highly correlated, and both the CSS and Bayesian estimates correlate well with the auxiliary variables used in this study. For tracts with large differences between the CSS and Bayesian estimates, correlations are much stronger for the Bayesian estimates.

Introduction

Measuring neighborhood quality is important for shaping many public policies. For instance, the U.S. Department of Housing and Urban Development's (HUD's) Housing Choice Voucher Program (HCVP) is intended to expand social and economic opportunities "outside areas of poverty or minority concentration" (HUD 2008: ch. 2, p. 2-1). In other words, the program is designed to promote access to decent and affordable housing in higher quality neighborhoods compared with neighborhoods of traditional public housing projects.

Despite its importance to policymakers, neighborhood quality is inherently complex and difficult to measure. Data are available on a wide variety of neighborhood characteristics, such as poverty rates, income, crime rates, and school test scores. Although many policymakers and researchers rely on such indicators, they may have limited ability to measure the quality of neighborhood life as rated by residents (Buron and Patrabansh, 2008).

Survey data are available that measure residents' subjective perceptions of their neighborhoods. The study described in this article analyzed neighborhood quality perception data from two surveys: (1) the American Housing Survey (AHS) and (2) HUD's Customer Satisfaction Survey (CSS). The AHS collects a large amount of information on housing conditions of American households.[1] The AHS is actually composed of two surveys, metropolitan and national, each taking place in different years. I employed 2002 metropolitan data for this study.

HUD's CSS was a 3-year survey of HCVP households.[2] Conducted between 2000 and 2002, its main objective was to provide independent housing quality data to public housing agencies. About 460,000 responses were collected.

Although the AHS and CSS contain many related questions, survey design differences make the direct comparison of AHS and CSS data difficult.[3] For a subset of data items, however, estimates from both surveys correlate well. For instance, despite substantial differences in question wording, Mast (2009a) reported similar crime perception estimates based on CSS and 2001 AHS data.

Two similar questions on each survey ask CSS and AHS respondents to rank both their home and neighborhood on a scale of 1 to 10. Estimates for HCVP households from the CSS and 2001 AHS are very close (Mast 2009b). Although many studies have examined differences in estimates from independent surveys, few researchers have attempted to combine information from independent surveys with Bayesian methods. This study attempted to extend this literature by using Bayesian methods to produce neighborhood quality indicators based on both the AHS and CSS.

CSS data pose several problems for measuring neighborhood quality. First, the neighborhood and home ratings are subjective ordinal ratings on a 1 to 10 scale. Although we could compute a mean rating, for ordinal data it is customary to compute only order statistics such as the median or other percentiles. The data do not easily lend themselves to standard statistical models that analyze the mean.

[1] AHS data and information are available at http://www.huduser.org/datasets/ahs.html.

[2] See Mast (2009b) and Gray, Haley, and Mast (2009) for more CSS information.

[3] See Gray, Haley, and Mast (2009) and Buron, Kaul, and Patterson (2003) for discussions of differences between the AHS and CSS.

Instead of analyzing raw ordinal ratings, I computed a binary (good or bad) neighborhood indicator by treating scores of at least 8 as high quality. If enough responses (at least 5) existed in each category for a neighborhood, the mean proportion followed an approximately normal distribution.

For most census tracts not nearly enough CSS responses existed to treat the tract distribution as normal, however. Even when combining CSS data for all 3 years of the survey, most census tracts have 4 or fewer CSS responses; this small number poses a second problem, because most statistical models for survey data assume normality of the sample mean. Instead of assuming normality, I treated the tract distributions as binomial data.

In addition to having small samples, many tracts have highly skewed distributions, with most or all households in the same binary category; this skewness poses a third problem. I proposed addressing the issue with a Bayesian model using prior information for the AHS. By drawing strength from the AHS, Bayesian methods can produce more reasonable estimates for many tracts with highly skewed CSS distributions.

Although sharp ideological differences exist between Bayesian and classical (or frequentist) statistics, in practice the most important difference concerns the use of prior information.[4] Although classical methods tend to let the data "speak for themselves," Bayesian estimates always condition on prior information. For this study, I started with prior information from the AHS and updated these estimates with CSS data.

I employed a particular Bayesian approach, referred to as a Bayesian Hierarchical Model, using metropolitan-level AHS data and CSS census tract data. Compared with tract estimates based only on CSS data, the Bayesian estimates have fewer outliers with very low or very high estimated quality.

To validate my estimates, I examined correlation of the CSS and Bayesian estimates with other measures of neighborhood quality, such as median income, poverty rates, and indicators for tracts receiving low-income housing tax credits (LIHTCs). The Bayesian estimates tend to correlate more strongly with these auxiliary variables, and the differences are more apparent for tracts with larger differences between the CSS and Bayesian estimates.

The remainder of the article proceeds as follows:

- A review of relevant studies.
- The survey data description.
- An explanation of the model.
- The empirical results.
- The estimates compared with other tract-level measures of neighborhood quality.
- A summary of the results.

[4] "Bayesians view statistical inference as a problem in belief dynamics, or use of evidence about a phenomenon to revise and update our knowledge about it." From course description at http://volgenau.gmu.edu/~klaskey/SYST664/SYST664.html. See Lee (2004) for an introduction to Bayesian methods.

Literature Review

In this section, I review two bodies of relevant literature. I start with a discussion of neighborhood quality studies. I then review past studies that have compared estimates from independent surveys.

Measuring Neighborhood Quality

Neighborhood quality is a difficult concept to quantify. According to Dubin (1992), measurement error is a likely cause for the lack of consistent effects of neighborhood quality indicators in hedonic housing price regressions.

The stalwarts of neighborhood quality measurement have traditionally been data on income, race, ethnicity, and poverty. Although, until recently, reliable neighborhood-level population, income, and poverty data were available only from the decennial census.[5]

Crime rates may also be useful measures of neighborhood quality. For instance, Deller and Ottem (2001) used county crime rates as neighborhood quality controls in hedonic property value regressions.

Crime rate data are also available at lower levels of aggregation for some localities. Cahill (2006) reported crime rates (averaged over 1998 through 2002) for census tracts and block groups for three U.S. cities (Nashville, Tucson, and Portland).[6] An increasing number of areas, such as Seattle, are making neighborhood crime data available through their crime mapping programs.[7]

Neighborhood quality should also be positively related to educational achievement. Sedgley, Williams, and Derrick (2008) found that eighth-grade test scores and SAT scores have significant positive effects on housing prices. They found no consistent effect for third-grade scores, however.

Survey measures are available that measure residents' subjective perceptions of their neighborhoods. Buron and Patrabansh (2008) provided evidence that subjective perceptions of neighborhood quality may not correlate highly with objective measures, such as poverty rates.

A related literature studied the differences in perceived neighborhood quality in the same localities due to differences in characteristics such as race, ethnicity, gender, and income (St. John and Clark, 1984). Differences may be especially apparent regarding neighborhood crime (Austin, Furr, and Spine, 2002). For instance, females may manifest more sensitivity toward violent crime.

Many researchers have measured perceived neighborhood quality with AHS data (Chapman and Lombard, 2006; Dilulio, 1994; Newman and Schnare, 1993). For instance, Hipp (2007) studied the relationship between AHS household crime perceptions and county crime rates. He found household perceptions of crime were more strongly related to violent crime than property crime.

[5] Designed to replace the decennial census long form, the American Community Survey will soon provide tract-level estimates (averaged over multiple years).

[6] See Cahill (2006) for data and information.

[7] http://spotcrime.com/wa/seattle.

Other studies have measured neighborhood quality with CSS data. Buron and Patrabansh (2008) studied the relationship between CSS household neighborhood quality responses and census data and, as indicated previously, they found little correspondence. This lack of correspondence calls into question the use of social indicators, such as poverty rates, as measures of neighborhood quality.

Buron and Patrabansh's findings, however, may be affected by their use of household-level data. This study found that resident perceptions aggregated to the tract level have fairly strong correlation with poverty and income.

Gray, Haley, and Mast (2009) reported wide variation in CSS neighborhood ratings across demographic groups. Mast (2009b), using CSS data, estimated that West Virginia crime perceptions relate more strongly with property crime than violent crime.

Comparing Estimates From Independent Surveys

Numerous studies have compared and contrasted estimates from independent surveys. For example, Bishaw and Stern (2006) examined differences in poverty estimates based on the Census Bureau's American Community Survey (ACS) and Current Population Survey (CPS).

A few studies have compared CSS and AHS estimates. Buron, Kaul, and Patterson (2003) matched 2001 CSS households with a sample of unassisted AHS households. Although they reported lower housing quality for HCVP households relative to similar unassisted families, they cautioned that their results may be driven by methodology and questionnaire differences.

Mast (2009a) studied crime perception questions on both the CSS and 2001 AHS. The wording of the crime question differs on the two surveys. The AHS asks residents if "a neighborhood crime problem" exists, and the CSS asks if crime or drugs "is a big problem in (the) neighborhood." Response options also differ. Despite these discrepancies, Mast (2009a) recoded responses into binary indicators with similar means. Of AHS HCVP households, 31.5 percent were estimated to have a crime problem compared with 33.8 percent of CSS households.

Two of the most similar questions on each survey ask AHS and CSS respondents to rank their home and neighborhood on a scale of 1 to 10. Mast (2009b) compared both rankings on the CSS with those for HCVP households in the 2001 AHS. For both homes and neighborhoods, CSS rankings are just slightly higher than AHS estimates for HCVP homes.

Mast (2009a) suggested that, because AHS and CSS crime estimates are similar, they are well suited for Bayesian methods. Because the CSS sample size is much larger than the AHS, I employed a Bayesian Hierarchical Model. AHS national estimates are used as priors, along with CSS county data, to estimate Bayesian posterior county estimates. Compared with estimates solely based on CSS data, the Bayesian estimates have lower variance and correlate more highly with county violent and property crime rates. Consistent with Hipp (2007), the relationship is strongest with violent crime.

Data Description

This section reports 2002 AHS and CSS summary statistics on three measures of neighborhood quality: neighborhood ratings, home ratings, and crime perceptions.

Both surveys ask respondents to rate the neighborhoods and homes on an ordinal scale of 1 to 10. Because the response categories are numerical, we could compute mean ratings. We would be making an assumption, however, that a rating of 6 is exactly twice as good as a rating of 3. For subjective ordinal data, it is therefore customary to compute only order statistics, such as the median or other percentiles.

Exhibit 1 reports percentiles (10th, 25th, median, 75th, and 90th) for neighborhood and home ratings. AHS data are reported for all occupied rental units and HCVP households. The CSS ratings are based on responses for HCVP households in the 13 AHS metropolitan areas between 2000 and 2002.[8] Survey responses for AHS renters are weighted to be representative of all renters in the 13 metropolitan areas; AHS HCVP and CSS responses are weighted to be representative of all voucher households in the 13 metropolitan areas.[9]

Neighborhood ratings correspond highly with home ratings. Neighborhood ratings in the 25th percentile are 6 for all three samples (AHS renters, AHS HCVP, and CSS). Home ratings in the 25th percentile are 6 for AHS renters, 7 for AHS HCVP households, and 6 for CSS families. All median ratings are 8. Neighborhood ratings in the 75th percentile are 9 for both AHS samples and 10 for the CSS. Home ratings in the 75th percentile are 9 for both AHS samples and 10 for the CSS.

Exhibit 1

Neighborhood and Home Rating Percentiles

Weighted Percentile	Neighborhoods			Homes		
	AHS–All Renters	AHS–HCVP Households	CSS	AHS–All Renters	AHS–HCVP Households	CSS
10th percentile	5	5	4	5	5	4
25th percentile	6	6	6	6	7	6
Median	8	8	8	8	8	8
75th percentile	9	9	9	9	10	10
90th percentile	10	10	10	10	10	10

AHS = American Housing Survey. CSS = Customer Satisfaction Survey. HCVP = Housing Choice Voucher Program.

For neighborhood ratings, N equals 16,458 for AHS renters, 503 for AHS-HCVP households, and 26,822 for the CSS. For home ratings, N equals 16,510 for AHS renters, 503 for AHS-HCVP households, and 26,987 for the CSS.

Source: Author's calculation using 2002 AHS and CSS data

[8] CSS data were matched to the AHS by county for counties in the 13 metropolitan areas according to the Office of Management and Budget June 1999 definitions. For information on metropolitan area definitions, see http://www.census.gov/population/www/metroareas/metrodef.html.

[9] The metropolitan AHS is stratified by metropolitan area, with weights summing to total households. The CSS is stratified by public housing agency (PHA) and year, with weights summing to HCVP households in all sampled PHAs in a given year. Only a tiny fraction of PHAs was excluded. For more information on the survey designs for the AHS, see http://www.huduser.org/datasets/ahs.html and, for the CSS, see Mast (2009b) and Gray, Haley, and Mast (2009).

We can compute binary indicators of high neighborhood and home ratings for which mean analysis is appropriate. For this study I treated ratings of at least 8 as high ratings. The threshold is admittedly arbitrary.

Exhibit 2 reports mean percentages of households with high neighborhood and high home ratings. More than one-half of the households in each sample rated their neighborhood 8 or above. Of AHS renters, 55.6 percent have high neighborhood ratings, as do 54.4 percent of AHS HCVP households and 52.8 percent of CSS households.

On average, voucher families tend to rate their homes better than renters in general. Of AHS HCVP families, 64.4 percent rate their homes 8 or above, as do 59.6 percent of CSS households; the corresponding mean for all AHS renters is 54.7 percent.

The wording of the crime question differs on the two surveys. The AHS asks households if their "neighborhood has a neighborhood crime problem." Response categories include "No," "Don't Know," and "Yes." The CSS asks if crime or drugs "is a big problem in (the) neighborhood." Response categories include "No Problem," "Don't Know," "Some Problem," and "Big Problem."

To facilitate comparison of crime variables from both surveys, I recoded responses as binary indicators of low crime. For the AHS, "Yes" responses were set to zero, and "No" and "Don't know" responses were treated as ones. For the CSS, "some problem" and "big problem" responses were set to zero, and "no problem" and "don't know" responses were set to one. Nonresponses for both surveys were set to missing.

Mean indicators of low-crime perceptions are reported in exhibit 2. Compared with all renters, voucher households rate their neighborhoods as less safe. Of all the renters surveyed, 77.0 percent do not perceive a major crime problem in their area. The corresponding means are 67.7 percent for AHS voucher households and 66.5 percent of CSS households.

Exhibit 2

Mean Indicators of High Neighborhood Quality

Variable	AHS–All Renters		AHS–HCVP Households		CSS–HCVP Households	
	Responses	Weighted Mean	Responses	Weighted Mean	Responses	Weighted Mean
High neighborhood rating	16,458	0.556	503	0.544	26,822	0.528
High home rating	16,510	0.547	503	0.644	26,987	0.596
Low-crime indicator	16,777	0.770	509	0.677	27,376	0.664

AHS = American Housing Survey. CSS = Customer Satisfaction Survey. HCVP = Housing Choice Voucher Program.
High home and neighborhood ratings are ≥8 on a scale of 1 to 10.
Source: Author's calculation using 2002 AHS and CSS data

Exhibits 3, 4, and 5 report summary statistics by metropolitan area for high neighborhood ratings, high home ratings, and low-crime indicators, respectively. According to the AHS, Phoenix has the lowest fraction of high neighborhood rating for all renters (0.517) and HCVP households (0.322). The Kansas City metropolitan area has the best neighborhood ratings, according to all AHS renters (0.595), and the worst neighborhoods according to CSS households. One possible explanation for differing opinions between all renters and voucher households is clustering of affordable rental

Exhibit 3

Mean Indicators of High Neighborhood Ratings, by Metropolitan Area

Metropolitan Area	AHS–All Renters		AHS–HCVP Households		CSS–HCVP Households	
	Responses	Weighted Mean	Responses	Weighted Mean	Responses	Weighted Mean
Santa Ana-Anaheim-Irvine, CA Division	1,513	0.562	44	0.563	1,624	0.610
Buffalo-Cheektowaga-Tonawanda, NY	1,022	0.535	57	0.485	1,734	0.546
Charlotte-Gastonia-Concord, NC-SC	1,014	0.579	18	0.600	2,237	0.538
Columbus, OH	1,230	0.541	55	0.464	1,651	0.453
Dallas-Plano-Irving, TX Division	1,437	0.560	41	0.616	3,677	0.494
Fort Worth-Arlington, TX Division	1,203	0.526	40	0.523	1,584	0.498
Kansas City, MO-KS	1,058	0.595	43	0.488	2,938	0.442
Miami-Fort Lauderdale-Miami Beach, FL	1,218	0.574	27	0.590	2,807	0.591
Milwaukee-Waukesha-West Allis, WI	1,388	0.581	30	0.566	1,681	0.451
Phoenix-Mesa-Scottsdale, AZ	1,200	0.517	30	0.322	2,375	0.499
Portland-Vancouver-Beaverton, OR-WA	1,271	0.525	32	0.433	1,609	0.534
Riverside-San Bernardino-Ontario, CA	1,386	0.553	28	0.563	1,344	0.514
San Diego-Carlsbad-San Marcos, CA	1,518	0.570	58	0.677	1,561	0.568

AHS = American Housing Survey. CSS = Customer Satisfaction Survey. HCVP = Housing Choice Voucher Program.
High neighborhood ratings are ≥8 on a scale of 1 to 10.
Source: Author's calculations using CSS and 2002 AHS data

units meeting HUD housing quality guidelines in particular neighborhoods. According to voucher households participating in the CSS, Santa Ana has the best neighborhoods.

Two of the three survey estimates rank Santa Ana as the safest metropolitan area. Of Santa Ana AHS renters, 84.3 percent report no major crime problem, as do 86.5 percent of AHS HCVP households and 80.6 percent of CSS respondents. Columbus is the least safe metropolitan area according to two of three survey measures. Of the AHS renters surveyed, 68.6 percent report no major crime problems in the Columbus area, compared with 53.0 percent of AHS HCVP households and 54.0 percent of CSS households. According to AHS voucher respondents, the Phoenix area has the greatest perceived crime problem, but the difference might merely reflect small sample size.

Exhibit 6 summarizes absolute values of percentage differences between the metropolitan-level AHS and CSS means reported in exhibits 3, 4, and 5. For each indicator of neighborhood quality, two differences are summarized—one between AHS renter means and CSS means and the other between AHS HCVP means and CSS means.

Exhibit 4

Mean Indicators of High Home Ratings, by Metropolitan Area

Metropolitan Area	AHS–All Renters		AHS–HCVP Households		CSS–HCVP Households	
	Responses	Weighted Mean	Responses	Weighted Mean	Responses	Weighted Mean
Santa Ana-Anaheim-Irvine, CA Division	1,517	0.531	44	0.666	1,641	0.701
Buffalo-Cheektowaga-Tonawanda, NY	1,026	0.563	57	0.674	1,741	0.608
Charlotte-Gastonia-Concord, NC-SC	1,016	0.550	18	0.718	2,242	0.583
Columbus, OH	1,235	0.511	55	0.576	1,660	0.526
Dallas-Plano-Irving, TX Division	1,445	0.558	41	0.741	3,690	0.539
Fort Worth-Arlington, TX Division	1,203	0.509	40	0.640	1,593	0.564
Kansas City, MO-KS	1,060	0.589	43	0.580	2,956	0.522
Miami-Fort Lauderdale-Miami Beach, FL	1,218	0.546	27	0.670	2,830	0.659
Milwaukee-Waukesha-West Allis, WI	1,393	0.589	30	0.678	1,691	0.543
Phoenix-Mesa-Scottsdale, AZ	1,205	0.549	30	0.702	2,390	0.547
Portland-Vancouver-Beaverton, OR-WA	1,279	0.512	32	0.648	1,630	0.624
Riverside-San Bernardino-Ontario, CA	1,392	0.554	28	0.423	1,356	0.587
San Diego-Carlsbad-San Marcos, CA	1,521	0.549	58	0.639	1,567	0.634

AHS = American Housing Survey. CSS = Customer Satisfaction Survey. HCVP = Housing Choice Voucher Program.
High home ratings are ≥8 on a scale of 1 to 10.
Source: Author's calculations using CSS and 2002 AHS data

Differences in mean neighborhood indicators based on AHS renters range from 0.4 percent in Phoenix to 29.5 percent in Kansas City, with a median of 7.2 percent in Riverside. Neighborhood indicator differences based on the AHS HCVP sample are slightly larger on average. The mean difference based on AHS renters is 9.5 percent, versus 14.1 percent for the AHS HCVP sample. Differences based on the AHS voucher sample vary from 0.2 percent in Miami to 43.2 percent in Phoenix, with a median difference of 10.9 percent in Charlotte.

Differences in home indicators by metropolitan area are quite similar in magnitude to differences in neighborhood indicators. The mean difference in home indicator means is 10.5 percent based on AHS renters and 14.3 percent based on AHS vouchers. Because the larger differences with the AHS vouchers are almost certainly a consequence of the small sample sizes, I consistently use the overall AHS renter population as the reference point for the remainder of the article.

When independent surveys estimate the same variable, Bayesian methods can produce a more reliable estimate using information from both surveys. The next section demonstrates how a Bayesian Hierarchical Model can produce more robust tract-level estimates using metropolitan AHS data and tract CSS data.

Exhibit 5

Mean Indicators of Low-Crime Perceptions, by Metropolitan Area

Metropolitan Area	AHS–All Renters		AHS–HCVP Households		CSS–HCVP Households	
	Responses	Weighted Mean	Responses	Weighted Mean	Responses	Weighted Mean
Santa Ana-Anaheim-Irvine, CA Division	1,530	0.843	44	0.865	1,668	0.806
Buffalo-Cheektowaga-Tonawanda, NY	1,074	0.783	60	0.745	1,756	0.636
Charlotte-Gastonia-Concord, NC-SC	1,028	0.806	19	0.659	2,264	0.634
Columbus, OH	1,243	0.686	56	0.530	1,692	0.540
Dallas-Plano-Irving, TX Division	1,461	0.725	42	0.668	3,746	0.629
Fort Worth-Arlington, TX Division	1,220	0.788	40	0.727	1,627	0.638
Kansas City, MO-KS	1,089	0.803	43	0.649	2,981	0.598
Miami-Fort Lauderdale-Miami Beach, FL	1,238	0.860	27	0.847	2,876	0.729
Milwaukee-Waukesha-West Allis, WI	1,418	0.725	30	0.600	1,713	0.591
Phoenix-Mesa-Scottsdale, AZ	1,215	0.706	30	0.518	2,418	0.572
Portland-Vancouver-Beaverton, OR-WA	1,300	0.707	32	0.561	1,642	0.703
Riverside-San Bernardino-Ontario, CA	1,399	0.771	28	0.679	1,379	0.684
San Diego-Carlsbad-San Marcos, CA	1,562	0.763	58	0.645	1,614	0.689

AHS = American Housing Survey. CSS = Customer Satisfaction Survey. HCVP = Housing Choice Voucher Program.

Source: Author's calculations using CSS and 2002 AHS data

Exhibit 6

Absolute Percentage Differences Between AHS and CSS Metropolitan Means

Absolute Percentage Difference	High Neighborhood Rating Indicator		High Home Rating Indicator		Low-Crime Indicator	
	AHS Renters vs. CSS (%)	AHS HCVP vs. CSS (%)	AHS Renters vs. CSS (%)	AHS HCVP vs. CSS (%)	AHS Renters vs. CSS (%)	AHS HCVP vs. CSS (%)
Minimum difference	0.393	0.186	0.482	0.804	0.528	0.667
Median difference	7.216	10.890	8.010	10.457	20.449	7.025
Mean difference	9.497	14.064	10.523	14.287	16.758	8.622
Maximum difference	29.515	43.146	27.590	32.500	29.237	22.588

AHS = American Housing Survey. CSS = Customer Satisfaction Survey. HCVP = Housing Choice Voucher Program.

Source: Author's calculations using CSS and 2002 AHS data

Data Analysis

This section analyzes neighborhood, home, and crime measures from the CSS and 2002 AHS. My goal was to produce Bayesian tract estimates of neighborhood quality based on both surveys. Although conventional Bayesian updating would require AHS and CSS tract-level estimates, the AHS sample is not large enough to produce reliable tract estimates. Therefore, I chose a Bayesian Hierarchical Model using AHS metropolitan estimates and CSS tract estimates.

AHS responses are aggregated at the metropolitan level for 13 metropolitan areas, and 26,264 CSS responses are aggregated into 3,749 census tracts in the AHS metropolitan areas.[10]

Neighborhood Indicators

Although the neighborhood and home ratings are ordinal, such data do not easily lend themselves to Bayesian methods.[11] For my analysis, I used the binary indicators of high neighborhood ratings (X_1), high home ratings (X_2), and low-crime perceptions (X_3) discussed previously.

Only a small percent of the CSS census tract samples meet the usual normality criteria for any of the indicators.[12] Therefore, I assumed X_1-X_3 follow a Binomial (n,p_i) distribution, for i = 1 to 3. n represents the number of weighted responses, which is the same for all indicators in a given census tract. I computed weighted responses by multiplying the original survey weight by responses divided by the sum of the original weights.[13]

Using weighted counts based on original sampling weights summing to total HCVP households would treat estimated counts as known values. This would grossly understate variance by ignoring sampling variability. To reduce bias, I used weighted counts with adjusted weights summing to responses. Compared with estimates based on the original sampling weights, this reweighting produces estimates with the same weighted means and a more realistic variance.

p_i represents the probability that indicator X_i equals 1. Although each indicator has a separate distribution for each tract, for simplicity I did not use tract subscripts.

p_i follows a Beta (α_i,β_i) probability distribution, where α_i equals the weighted count of high-quality indicators. β_i equals the weighted count of low-quality indicators, which equals n - α_i. The Beta probability distribution has a mean $\alpha/(\alpha + \beta)$ and standard deviation equal to the square root

[10] I excluded 2,397 CSS responses when either (1) the address could not be accurately geocoded at the tract level or (2) no valid response existed for the home rating, neighborhood rating, or crime question.

[11] Limited combinations of distributions exist for data and parameters, referred to as conjugate pairs, with analytic solutions for Bayesian posterior distributions. Although a conjugate model for multinomial categorical data exists, it does not account for ordering of the categories. Therefore, I employed a binomial-beta conjugate model, where the household neighborhood indicators are binomial and the probability of a high rating follows a beta distribution. For a Bayesian analysis of AHS and CSS data with a normal-normal conjugate model, see Mast (2009a).

[12] I considered a CSS tract sample proportion to be normally distributed if weighted responses were at least 30 and each binary category had at least 5 weighted responses.

[13] Let Wi be the original survey weight with n responses summing to population, and let Wi* be the adjusted weight summing to responses: $Wi^* = nWi/\sum Wi$.

of $\alpha\beta/[(\alpha + \beta)^2(\alpha + \beta + 1)]$. For example, if n = 45 and we have 30 high-quality responses, the estimated probability that a random tenant would give the neighborhood a high rating would be 0.667, with a standard deviation of 0.005.

Exhibit 7 reports descriptive statistics for the 3,749 CSS tract distributions of X_1-X_3. The first variable listed is X_1, the indicator for high neighborhood ratings. Weighted responses for X_1 vary from 0.096 to 173.486, with a median of 3.984 and a mean of 7.043. α_1, the count of high neighborhood ratings, ranges from 0 to 171.083. The median number of high neighborhood ratings equals 2.088, and the mean is 3.720. p_1, the mean probability of a high neighborhood rating, varies across census tracts from 0 to 1. 543 tracts have $p_1 = 0$ (no high neighborhood ratings), and 1,122 have $p_1 = 1$ (all high ratings); these tracts have 0 standard deviation. The median probability of a high neighborhood rating is 0.619, and the mean is 0.593.

CSS respondents rate their homes slightly higher on average than their neighborhoods. X_2 is the indicator of high home ratings, and the p_2 is the mean probability of a high home rating. The median value of p_2 is 0.680, and the mean is 0.638.

Most CSS households do not report major crime problems in their neighborhoods. X_3 indicates low-crime perceptions, and p_3 is the mean probability of a low-crime perception. p_3 has a median of 0.816 and a mean of 0.713.

Exhibit 7

CSS Census Tract Summary Statistics

	X_1 (High Neighborhood Rating)			
	Minimum	**Median**	**Mean**	**Maximum**
Weighted responses	0.096	3.984	7.043	173.486
Count of high ratings (α)	0.000	2.088	3.720	171.083
Count of low ratings (β)	0.000	1.305	3.323	170.264
Mean probability of a high rating (p)	0.000	0.619	0.593	1.000
Standard deviation of p	0.000	0.087	0.093	0.443
	X_2 (High Home Rating)			
	Minimum	**Median**	**Mean**	**Maximum**
Weighted responses	0.096	3.984	7.043	173.486
Count of high ratings (α)	0.000	2.281	4.202	171.901
Count of low ratings (β)	0.000	1.133	2.841	46.045
Mean probability of a high rating (p)	0.000	0.680	0.638	1.000
Standard deviation of p	0.000	0.091	0.094	0.443
	X_3 (Low-Crime Perception)			
	Minimum	**Median**	**Mean**	**Maximum**
Weighted responses	0.096	3.984	7.043	173.486
Count of high ratings (α)	0.000	2.550	4.657	169.881
Count of low ratings (β)	0.000	0.662	2.386	45.114
Mean probability of a high rating (p)	0.000	0.816	0.713	1.000
Standard deviation of p	0.000	0.056	0.081	0.457

CSS = Customer Satisfaction Survey.

N = 3,749 tracts.

Source: Author's calculations using CSS data

Bayesian Estimates

The Bayesian posterior distribution of p_i for each tract follows a Beta (α_i^*,β_i^*) distribution where $\alpha_i^* = \alpha_{i,prior} + \alpha_i$, and $\beta_i^* = \beta i,_{prior} + \beta_i$. $\alpha_{i,prior}$ is our prior best guess for the number of high ratings, with no knowledge of the CSS data. $\beta_{i,prior}$ is our prior guess for the number low ratings. α_i is the CSS weighted count of high ratings, and β_i is the CSS weighted count of low ratings.

Reliable tract-level information from the AHS is not available. Therefore, I employed a Bayesian Hierarchical Model adopted from Gelman et al. (2004).[14] For each metropolitan area, I used a common prior distribution for all tracts in that metropolitan area based on the AHS data. As noted previously, I used data for all AHS renters.[15]

α_{prior} is set to the AHS weighted mean probability of a high rating multiplied by 4, and β_{prior} is set to 4- α_{prior}. This results in a prior Beta distribution with the same weighted mean as the AHS metropolitan distribution but a smaller sample size of 4 and a larger standard deviation.

Using the AHS number of weighted responses for the prior sample size would result in posterior distributions dominated by the AHS for most tracts. For a tract with the median CSS weighted responses close to 4, my choice of 4 for the prior sample size results in a posterior distribution where the AHS and CSS have approximately equal influence.

For example, consider X_2 (high home rating). Exhibit 8 depicts the prior, CSS, and Bayesian posterior probability density functions for X_2 in one tract (045031100) in one randomly selected metropolitan area (Columbus). The tract was chosen because CSS weighted responses of 3.803 are close to 4 (the median for all metropolitan areas). The AHS-based metropolitan prior distribution has 2.045 high ratings, 1.955 low ratings, and a mean probability of a high rating equal to (2.045/4) or 0.511. The prior standard deviation is 0.224. The CSS tract distribution is highly skewed toward favorable ratings, with 3.370 weighted high ratings, 0.433 weighted low ratings, and a mean probability of (3.370/3.803) or 0.866. The CSS tract standard deviation is 0.145.

The Bayesian posterior distribution is distributed Beta (α^*,β^*) with $\alpha^* = 2.045 + 3.370 = 5.415$, and $\beta^* = 1.955+ 0.433 = 2.388$. The posterior mean probability equals 5.415/(5.415 + 2.338) or 0.694. Because the prior and CSS distribution have about the same sample size, the posterior mean is approximately a simple average of the prior and CSS means. The posterior standard deviation is 0.155.

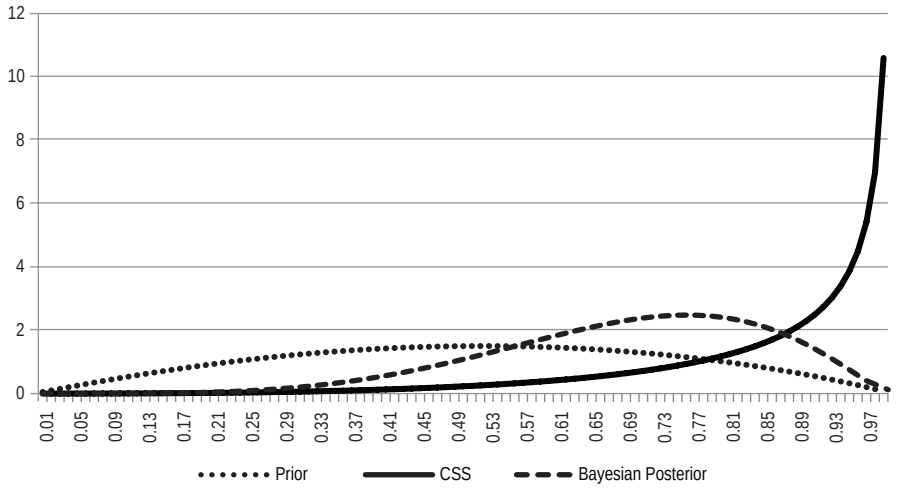
When CSS weighted responses increase, the CSS data have greater influence on the posterior distribution. Exhibit 9 depicts the X_2 prior, CSS, and posterior probability density functions for Columbus area tract 041011520. The tract was chosen because it has 8.972 weighted CSS responses, which is close to 9 (the 75th percentile for all metropolitan areas). The metropolitan-level prior distribution, described previously, has a mean of 0.511. The CSS tract distribution has a mean of 0.329 and

[14] For an accessible introduction to Bayesian Hierarchical Models, see http://volgenau.gmu.edu/~klaskey/SYST664/Bayes_Unit5.pdf.

[15] I also produced Bayesian posterior estimates using metropolitan priors based on the AHS HCVP sample. These estimates had lower correlation with auxiliary variables compared with estimates with priors based on all renters (results available upon request).

Exhibit 8

X_2 Prior, CSS, and Bayesian Posterior Probability Density Functions—
Columbus Tract 045031100



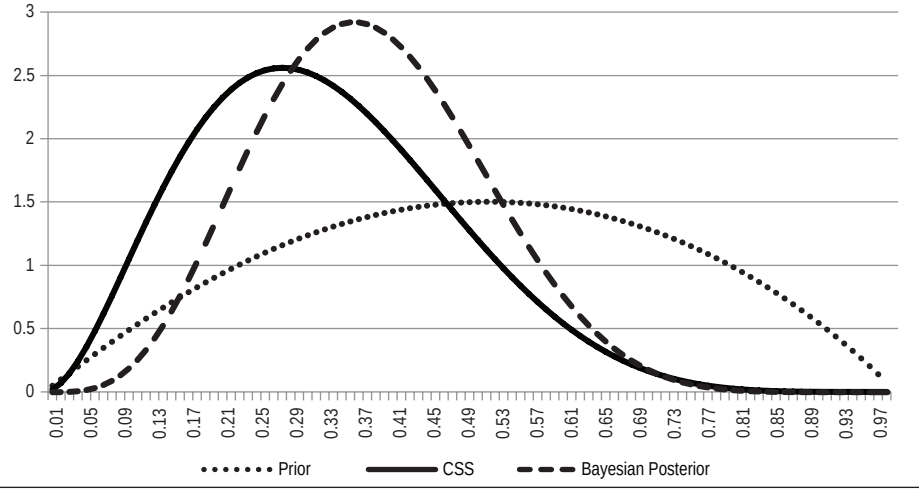
CSS = Customer Satisfaction Survey.

X_2 is an indicator for a high home rating. The Columbus metropolitan area was randomly chosen. The tract was chosen with CSS weighted responses closest to the median = 4.

Source: Author's calculations using CSS and 2002 American Housing Survey data

Exhibit 9

X_2 Prior, CSS, and Bayesian Posterior Probability Density Functions—
Columbus Tract 041011520



CSS = Customer Satisfaction Survey.

X_2 is an indicator for a high home rating. The Columbus metropolitan area was randomly chosen. The tract was chosen with CSS weighted responses closest to the 75th percentile = 9.

Source: Author's calculations using CSS and 2002 American Housing Survey data

a standard deviation of 0.149. The posterior distribution has a mean probability of a high rating equal to 0.385. The CSS sample size is about 2.25 times that of the prior sample size of 4, thus the CSS has about 2.25 times the influence on the posterior distribution.

Exhibit 10 reports summary statistics for the Bayesian posterior means and standard deviations. Exhibit 11 depicts a histogram of CSS and Bayesian means for X_1 (high neighborhood rating). The mean of the 3,749 Bayesian mean estimates for X_1 is 0.558, which is lower than the CSS mean of 0.593 reported in exhibit 7. Compared with CSS estimates, the Bayesian estimates are much more normally distributed, with fewer tracts with very low or high means. The CSS estimates for X_1 have 543 tract distributions with mean = 0 and 1,122 with mean = 1; these degenerate distributions have 0 standard deviation. The Bayesian mean estimates, however, range from 0.031 to 0.985. Although the CSS standard deviations range from 0 to 0.443, the Bayesian standard deviations range from 0.009 to 0.221.

Exhibit 10

Summary Statistics for Bayesian Posterior Distributions

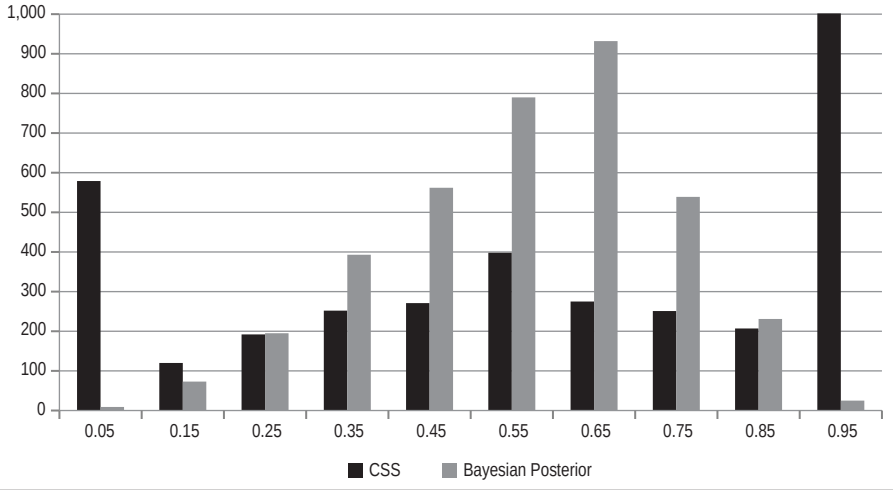
	X_1 (High Neighborhood Rating)		X_2 (High Home Rating)		X_3 (Low-Crime Perception)	
	Mean	**Std**	**Mean**	**Std**	**Mean**	**Std**
Minimum	0.031	0.009	0.080	0.008	0.088	0.009
Median	0.577	0.156	0.598	0.156	0.764	0.133
Mean	0.558	0.152	0.581	0.152	0.726	0.132
Maximum	0.985	0.221	0.989	0.221	0.985	0.208

N = 3,749 tracts.

Source: Author's calculations using Customer Satisfaction Survey and 2002 American Housing Survey data

Exhibit 11

Histogram of CSS and Bayesian Mean Estimated Probabilities for X_1



CSS = Customer Satisfaction Survey.

N = 3,749 tracts. X_1 is an indicator for a high neighborhood rating.

Source: Author's calculations using Customer Satisfaction Survey and 2002 American Housing Survey data

Data Validation

This section compares the CSS and Bayesian estimates with other tract-level measures of neighborhood quality. These variables include median household income, percent of families living below the poverty line, and an indicator for 671 tracts qualifying for LIHTC.[16] Exhibit 12 reports summary statistics for these measures.

Exhibit 13 reports Pearson correlation coefficients for the previously mentioned auxiliary variables with the CSS and Bayesian estimated mean probabilities for X_1-X_3. All coefficients are significant at the 0.0001 level with the expected signs. Median income is positively related with neighborhood quality, although the poverty rate and the LIHTC indicator correlate negatively.

For each neighborhood indicator, the CSS and Bayesian correlations with the auxiliary variables are very close. Of course, the Bayesian distributions are a weighted average of the prior and CSS distributions. As such, the CSS and Bayesian estimates are highly correlated. The Pearson correlation coefficient between the CSS and Bayesian means for X_1 (high neighborhood rating) is 0.866. The Bayesian model is not intended to drastically change most of the CSS estimates; its purpose is to reduce outliers and make estimation possible for tracts with few CSS responses. Differences may be more apparent for tracts with larger differences between the CSS and Bayesian estimates.

Exhibit 12

Summary Statistics for Auxiliary Neighborhood Quality Measures

Variable	Minimum	Median	Mean	Std
Median income*	7483.000	38946.000	40470.806	14473.096
Poverty rate*	0.280	12.140	15.029	10.814
LIHTC indicator**	0.000	0.000	0.179	0.383

LIHTC = low-income housing tax credit. N = 3,749 tracts.

*Sources: *U.S. Census Bureau 2000 Census; **http://www.huduser.org/datasets/lihtc.html*

Exhibit 13

Pearson Correlation Coefficients

Auxiliary Variable	X_1 (High Neighborhood Rating)		X_2 (High Home Rating)		X_3 (Low-Crime Perception)	
	CSS Mean	Bayesian Mean	CSS Mean	Bayesian Mean	CSS Mean	Bayesian Mean
Poverty rate	– 0.371	– 0.371	– 0.256	– 0.225	– 0.346	– 0.366
Median income	0.332	0.312	0.232	0.182	0.313	0.321
LIHTC indicator	– 0.263	– 0.270	– 0.169	– 0.162	– 0.238	– 0.260

CSS = Customer Satisfaction Survey. LIHTC = low-income housing tax credit.

N = 3,749 tracts. All correlation coefficients are significant at the .0001 level.

Source: Author's calculations using U.S. Census Bureau, HUD LIHTC, 2002 American Housing Survey, and CSS data

[16] LIHTC data indicators are for tracts qualifying in any year between 2000 and 2003. Original data were for qualifying tracts based on 1990 geography. For this study, I constructed qualifying tracts based on 2000 geography. For tracts that changed, I assumed a tract with 2000 geography qualified if it included any part of a tract qualified based on 1990 geography.

Exhibit 14 reports Pearson correlation coefficients for tracts with an absolute percentage difference between CSS and Bayesian estimates at or above the median difference. Median differences are 24.5 percent for X_1, 21.6 percent for X_2, and 14.4 percent for X_3. All of the correlations coefficients are significant at the 0.0001 level. For this subsample of tracts, 8 of the 9 Bayesian correlation coefficients are larger in absolute magnitude than their corresponding CSS coefficients.

Exhibit 15 reports Pearson correlation coefficients for tracts with an absolute percentage difference between CSS and Bayesian estimates at or above the 66th percentile; 66th-percentile differences are 55.3 percent for X_1, 52.4 percent for X_2, and 27.0 percent for X_3. All of the correlation coefficients are significant at the 0.0001 level. For this subsample of tracts, all Bayesian correlation coefficients are larger in absolute magnitude than their corresponding CSS coefficients. In addition, the differences between the CSS and Bayesian correlation coefficients are much larger for this subsample.

Exhibit 14

Pearson Correlation Coefficients, Subsample of Tracts With Differences Between CSS and Bayesian Estimates ≥ the Median

Auxiliary Variable	X_1 (High Neighborhood Rating)		X_2 (High Home Rating)		X_3 (Low-Crime Perception)	
	CSS Mean	Bayesian Mean	CSS Mean	Bayesian Mean	CSS Mean	Bayesian Mean
Poverty rate	– 0.430	– 0.463	– 0.301	– 0.309	– 0.407	– 0.460
Median income	0.379	0.397	0.252	0.246	0.381	0.417
LIHTC indicator	– 0.320	– 0.339	– 0.206	– 0.214	– 0.268	– 0.302

CSS = Customer Satisfaction Survey. LIHTC = low-income housing tax credit.

All correlation coefficients are significant at the 0.0001 level. N = 1,870 for X_1 and 1,874 for X_2 and X_3.

Source: Author's calculations using U.S. Census Bureau, HUD LIHTC, American Housing Survey 2002, and CSS data

Exhibit 15

Pearson Correlation Coefficients, Subsample of Tracts With Differences Between CSS and Bayesian Estimates ≥ the 66th Percentile

Auxiliary Variable	X_1 (High Neighborhood Rating)		X_2 (High Home Rating)		X_3 (Low-Crime Perception)	
	CSS Mean	Bayesian Mean	CSS Mean	Bayesian Mean	CSS Mean	Bayesian Mean
Poverty rate	– 0.422	– 0.492	– 0.348	– 0.402	– 0.382	– 0.468
Median income	0.398	0.448	0.308	0.343	0.408	0.468
LIHTC indicator	– 0.294	– 0.340	– 0.217	– 0.254	– 0.244	– 0.290

CSS = Customer Satisfaction Survey. LIHTC = low-income housing tax credit.

All correlation coefficients are significant at the 0.0001 level. N = 931 for X_1, and 938 for X_2 and X_3.

Source: Author's calculations using U.S. Census Bureau, HUD LIHTC, 2002 American Housing Survey, and CSS data

Conclusion

Although neighborhood quality is important for shaping public policy, it is also difficult to quantify. This study measured neighborhood quality using data from two sources: (1) the 2002 American Housing Survey and (2) HUD's Customer Satisfaction Survey of Section 8 Housing Choice Voucher Program households.

Although the AHS and CSS contain related questions, differences in survey methods and the questions' wording make direct comparison of the two surveys difficult. Bayesian methods are flexible enough, however, to use information from related questions from both surveys.

I examined survey responses in 13 metropolitan areas regarding neighborhood quality, home quality, and crime perceptions. Tract-level Bayesian estimates are computed using AHS metropolitan-level data and CSS census tract data.

Compared with estimates solely based on CSS data, the Bayesian estimates have fewer outliers. Bayesian analysis also allows for estimation for tracts with lower sample sizes than would be practical using only CSS data.

I compared the CSS and Bayesian estimates with other measures of neighborhood quality, such as poverty rates, median income, and indicators for tracts receiving low-income housing tax credits. The CSS and Bayesian indicators are highly correlated, and both the CSS and Bayesian correlate well with these auxiliary variables. For tracts with large differences between the CSS and Bayesian estimates, correlations are much stronger for the Bayesian estimates.

Future research could focus on testing the value of Bayesian neighborhood quality measures as left-hand-side and right-hand-side variables in any number of quantitative studies.

Acknowledgments

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Impact

A regulatory impact analysis must accompany every economically significant federal rule or regulation. The Office of Policy Development and Research performs this analysis for all U.S. Department of Housing and Urban Development rules. An impact analysis is a forecast of the annual benefits and costs accruing to all parties, including the taxpayers, from a given regulation. Modeling these benefits and costs involves use of past research findings, application of economic principles, empirical investigation, and professional judgment.

The Impacts of More Rigorous FHA Underwriting Guidelines

Alastair McFarlane
U.S. Department of Housing and Urban Development

Summary of Impact Analysis

The Federal Housing Administration's (FHA's) authorizing statute for insurance authorities, the National Housing Act, clearly states that the U.S. Department of Housing and Urban Development (HUD) will adjust program standards and practices to operate the Mutual Mortgage Insurance Fund (MMIF) on a self-sustaining basis. In the Notice "Federal Housing Administration Risk Management Initiatives: Reduction of Seller Concessions and New Loan-to-Value and Credit Score Requirements,"[1] FHA proposes to tighten portions of its underwriting guidelines that present an excessive level of risk to both homeowners and FHA. The benefit of the set of actions outlined in the Notice will reduce the net losses resulting from high rates of insurance claims on affected loans, and the cost of the action will be the value of the loan opportunity denied to the excluded borrowers. The total transfer to FHA would be $96 million, and the net cost of excluding borrowers could be as high as $85 million.

Need for Policy Change

FHA has resumed a countercyclical position, supporting private lending for homeownership when access to private sources of capital for credit enhancements is otherwise constrained by the recent financial crisis. This state of affairs is most evident in the rapid increase in the volume of FHA

[1] "Federal Housing Administration Risk Management Initiatives: Reduction of Seller Concessions and New Loan-to-Value and Credit Score Requirements," FR-5404-N-01. *Federal Register*, July 15, 2010. Available at http://federalregister.gov/a/2010-17326.

insurance as private sources of mortgage finance retreated from the market. The growth in the MMIF portfolio over a 2-year period coincides with a set of difficult economic conditions, namely, continued housing price declines and increasing levels of unemployment. Together, these external conditions increase the risk of additional losses to FHA.

A recently issued independent actuarial study[2] shows that the MMIF capital ratio has fallen below its statutorily mandated threshold of 2 percent. The study reported that FHA would likely sustain significant losses from mortgage loans made before 2009 due to the high concentration of seller-funded downpayment assistance mortgage loans and declining real estate values nationwide.

FHA can implement four primary policy changes to replenish the MMIF capital reserve account: (1) increase premium rates to raise income, (2) reduce losses on new business by tightening underwriting guidelines, (3) strengthen enforcement measures to reduce unwarranted claim payments, and (4) avoid claims through enhanced loss mitigation efforts. FHA is engaged in efforts on all these fronts, exercising its full authority under the terms of the National Housing Act, including new authorities provided in recently enacted legislation. This Notice further complements the underwriting approach to strengthening FHA's fiduciary responsibilities.

Summary of Notice

First, FHA proposes to reduce the amount of financing costs that the property seller or other interested party may pay on behalf of a homebuyer using an FHA-insured mortgage. This proposed cap on seller concessions would more closely align FHA's single-family mortgage insurance programs with standard industry practice and minimize FHA exposure to the risk of insuring borrowers most likely to default. When a homeseller or interested third party pays all or part of the buyer's cost of financing, the payments are commonly referred to as *seller concessions*. Although HUD previously allowed seller concessions up to 6 percent of the sales price, conventional mortgage lenders have capped seller concessions at 3 percent of the sales price on loans with loan-to-value (LTV) ratios similar to FHA standards. FHA proposes to cap the seller concession in FHA-insured single-family mortgage transactions at 3 percent of the lesser of the sales price or appraised value for purposes of calculating the maximum mortgage amount. Although seller concessions above 3 percent would not be prohibited under this proposal, concessions that exceed FHA's 3-percent cap would require a dollar-for-dollar reduction in the sales price for the purposes of calculating the maximum FHA loan amount. One reason for this change is that borrowers who received more than 3 percent in seller concessions had a significantly higher risk of losing their homes. This proposed cap will not only align FHA's single-family mortgage insurance programs to private industry practice but also will help ensure that borrowers who rely on FHA-insured financing have a sufficient investment in their home, thereby making them less likely to default on the mortgage.

Second, FHA proposes to introduce a two-part credit-score threshold, with a lower threshold for loans with LTV ratios of 90 percent or less and a higher threshold for those loans with higher LTV ratios. This will be the first time that FHA has ever instituted an absolute lower threshold for borrower credit scores (as measured by FICO). Borrowers with low credit scores present higher risks

[2] See IFE (2009).

for defaulting and filing a mortgage insurance claim. FHA is proposing to introduce a minimum decision credit score of no less than 500 to determine eligibility for FHA financing and to also reduce the maximum LTV for all borrowers with decision credit scores of less than or equal to 579. Maximum FHA-insured financing (96.5-percent LTV for purchase transactions and 97.75-percent LTV for rate-and-term refinance transactions) would be available only to borrowers with credit scores at or above 580. All borrowers with decision credit scores between 500 and 579 would be limited to a maximum 90-percent LTV.

Although today FHA is serving very few borrowers with credit scores below 500, as shown in exhibit 1, the performance of these borrowers is clearly very poor, as reflected in exhibit 2. Borrowers with credit scores below 500 struggle to meet their mortgage obligations. The percentage of borrowers who ultimately lose their homes is twice as high for borrowers with lower credit scores. Similarly, FHA data demonstrate that borrowers with decision credit scores below 580, who invest only a minimal amount of funds into the transaction, struggle to make their mortgage payments and ultimately lose their homes at a rate that is unacceptable to FHA. The borrowers affected by this Notice have seriously delinquent rates that are four to five times higher than those who remain eligible.

Third, FHA will tighten underwriting standards for mortgage loan transactions that are manually underwritten. The purpose of mortgage underwriting is to determine a borrower's ability and willingness to repay the debt and to limit the probability of default. For cases in which the borrower has a very limited or nontraditional credit history, the credit bureaus may not be able to calculate a credit score. Mortgage loans for borrowers in this category will need to be manually underwritten. These categories of borrowers present a higher level of risk and, as a result, manual underwriting guidelines, in general, are more stringent to address that higher risk level.

Costs and Benefits

Given the importance of maintaining a viable MMIF for existing and future homeowners, it is FHA's intent to focus only on particular practices that have been found to result in extremely poor mortgage loan performance.

Aggregate Loans Affected

The highlighted portion of exhibit 1 indicates the proportion of borrowers expected to be immediately excluded from the FHA guarantee by the Notice, relative to the total FHA portfolio. This policy is still important to FHA because HUD's expectation are that, after the conventional mortgage market recovers and lenders again loosen underwriting standards, FHA could be adversely selected with larger shares of these higher risk loans. As late as fiscal year (FY) 2008, loans that would be newly excluded under this proposed policy accounted for more than 8 percent of all loans insured by FHA (excluding streamline refinancing).

Exhibit 2 clearly indicates through the performance data provided that these borrowers are at a significantly greater risk of losing their homes than are other FHA-insured borrowers. The seriously delinquent rate of borrowers subject to the proposed restrictions (weighted average across the three cells in exhibit 2) is 30.6 percent, while the rate for all other mortgage loans is 6.4 percent.

Exhibit 1

FHA Single-Family Insurance Endorsement Shares in Calendar Year 2009

Loan-to-Value Range	Credit Score Ranges					
	None	300–499	500–579	580–619	620–679	680–850
Up to 90%	0.03	0.01	0.12	0.48	2.28	3.51
Above 90%	0.34	0.02	1.39	7.24	35.80	48.77

FHA = Federal Housing Administration.

Source: U.S. Department of Housing and Urban Development/FHA; "Federal Housing Administration Risk Management Initiatives: Reduction of Seller Concessions and New Loan-to-Value and Credit Score Requirements," Table A, FR-5404-N-01, Federal Register*, July 15, 2010, available at http://federalregister.gov/a/2010-17326*

Exhibit 2

FHA Single-Family Mortgage Insurance: Seriously Delinquent Rates by LTV and Credit Scores

Loan-to-Value range	Credit Score Ranges					
	None	300–499	500–579	580–619	620–679	680–850
Up to 90%	13.3	35.4	22.4	15.7	6.1	1.5
Above 90%	20.9	43.3	30.4	19.6	8.6	2.3

FHA = Federal Housing Administration. LTV = loan to value.

Note: Seriously delinquent rates measure the sum of cases that are 90 days or more delinquent, in foreclosure, and in bankruptcy as a percent of all actively insured loans on a given date.

Source: U.S. Department of Housing and Urban Development/FHA; "Federal Housing Administration Risk Management Initiatives: Reduction of Seller Concessions and New Loan-to-Value and Credit Score Requirements," Table B, FR-5404-N-01, Federal Register*, July 15, 2010, available at http://federalregister.gov/a/2010-17326*

In 2008, FHA endorsements numbered 1.4 million and were, as of the third quarter of 2009, approaching an annual level of approximately 2 million (U.S. Housing Market Conditions, November 2009). Current endorsement levels are likely to be a historic maximum. In normal years, endorsement levels are closer to 1.5 million. In our modeling, we used 1.5 million as the default, 2 million as a maximum, and 1 million as minimum. Multiplying these endorsement numbers by the current share of subprime loans—1.42 percent—yields an assumed total of loans affected by the Notice of 21,300, with a maximum of 28,400 and a minimum of 14,200.

Benefit of Policy Change

The direct purpose of the policy change outlined in this Notice is to achieve the statutorily mandated minimum capital reserve ratio of 2 percent. The broader purpose of the policy change, however, is to ensure the survival of the FHA so that it can continue to provide mortgage loans when private markets fail. The current financial crisis has led to a credit crunch in which FHA has been a lender of last resort to low-income and risky borrowers. Today, FHA's share of the single-family mortgage market is approximately 20 percent, up from 2 percent in 2007, and the dollar volume of insurance written has jumped from just $56 billion in 2007 to more than $300 billion in 2009. Facilitating the provision of credit during a liquidity crisis is a welfare-enhancing activity, and FHA provides such a public benefit. Quantifying this benefit would involve measuring the extent to which this Notice increased the survival of the FHA and multiplying this probability by an estimate of the public benefit of FHA endorsement activities.

The current financial crisis has been attributed to many different causes—from government failure to a natural readjustment of markets. Many good arguments, however, support the theory that a financial crisis is the result of inefficiencies caused by imperfect information and perverse incentives. For example, Stiglitz, Jaramillo-Vallejo, and Park (1993) describe a negative selection externality that "bad" financial firms have on "good" financial firms during a credit crunch. The mere perception of a troubling credit market can affect investors' willingness to provide equity to good firms. Because bad firms' actions have spoiled the market, investors will not provide an efficient level of capital to the financial market. Cassidy (2009) explains in great detail how this scenario fits the current financial crisis. Large financial institutions have borrowed from others to make bets on risky assets using complex financial instruments. Given the complexity of these financial arrangements, it is difficult, even for well-informed insiders, to gauge the value of the firms holding these risky assets on their balance sheets. After housing price appreciation began to slow down and the value of the financial institutions investing subprime mortgage-backed securities (MBS) became uncertain, lenders were unwilling to provide credit to these large institutions because they feared that the borrower would not be able to repay. The result was an economy-wide credit crunch in which ordinary borrowers were not able to acquire a loan at a reasonable cost.

In another example of a market failure, the monitoring of financial firms is a public good that is undersupplied (Stiglitz, Jaramillo-Vallejo, and Park, 1993). Institutional banks will not decrease their leverage ratios to a point that reduces systemic risk for the entire financial market. Within a financial institution, management has the ability to limit its firm's risk to decrease the likelihood that their firm collapses. The benefit from a firm lowering its risk, however, will have spillover benefits to all the financial market stakeholders by lowering the chance of contagion. As a result, a financial institution will not receive enough compensation to lower its leverage ratio to the efficient level. In hindsight, many of the financial institutions originating MBS can be considered to have become overleveraged during the years preceding the financial crisis of 2007–2010.

FHA loans are now in higher demand as a result of the failure or withdrawal of private investors from the mortgage market. Thus, the primary contribution of FHA to the public welfare is to facilitate the transition to sustainable homeownership for low-income or credit-constrained individuals when the market is not achieving this goal on its own. Because both private and public benefits (described in the next section) are associated with homeownership, a postponement of those benefits, as a result of a poorly functioning credit market, would represent a reduction in welfare.

Cost of Excluding Borrowers

The goal of FHA is to promote a national housing policy by providing access to mortgage credit for first-time homebuyers and others with limited financial wealth. Tightening underwriting guidelines will cause excluded households to delay their transition to homeownership status (or perhaps never make the transition). For refinance loans, the proposed restrictions will cause higher housing costs until such time as when the excluded households can improve their credit histories and gain more home equity through general market-level house price appreciation. A few analytical options estimate the gains to FHA loan program participants (and thus the cost of being excluded).

Costs of a Different Mortgage Loan

One approach to measuring the advantages of an FHA loan is to estimate the private gain to the household of an FHA loan by deriving an estimate of the additional costs a borrower would have to pay to receive a similar loan not insured by FHA. FHA does not earn a profit as a private mortgage insurer would. The average gain would be what the borrower would have had to pay for the same insurance on the private market. The disadvantage of this approach is that it is no longer current practice to insure borrowers with low credit scores. The private mortgage insurance market has never served the segment of borrowers who would be eliminated from FHA eligibility by this Notice, and the subprime market where they previously could have turned for home financing no longer exists. Although the FHA guaranty has value, it would be impossible to measure it through such a method.

Private Benefits of Homeownership

A second approach is to compare the private benefits of renting with the benefits of homeownership. Given the state of the market, an FHA-guaranteed loan may represent the only path to homeownership for low-income households. Those households that apply for a loan clearly believe that ownership is the optimal financial decision. Some of the potential benefits of homeownership would be a lower quality-adjusted price for housing, higher satisfaction, and wealth creation.[3]

A tenant could be expected to pay less for the same unit of housing as an owner occupant than as a renter. Higher costs for renters arise because of an information asymmetry. A landlord does not know in advance of extending a lease to what extent a tenant will inflict damage, make an effort to take care of the property, or report urgent problems. An owner occupant, on the other hand, has a financial interest in taking care of the property. Thus, both the depreciation and maintenance costs of rental housing can be expected to be higher—a market imperfection that will create an incentive for transition to owner-occupied housing. The difference in owner-occupant and renter behavior would also lead to a difference in the type of housing offered; in general, owner-occupied housing is of a higher quality.

Higher satisfaction from owner occupancy stems from the greater freedom to alter the property to suit one's taste and from not being subject to variable housing costs (when the alternative is a fixed-rate mortgage). It is also possible that owner occupancy provides access to neighborhoods and municipalities where long-term rental housing is hard to find.

A frequently perceived benefit of ownership is one of wealth creation. The federal government encourages investment in residential real estate by, in most cases, not taxing the capital gains from selling one's home. The asset-building advantage of homeownership materializes only when housing prices appreciate. The downside of homeownership, of course, is the risk of investing most of one's wealth into a single asset. Foreclosure would represent a greater hardship than eviction from a rental property. In the current market, it is unlikely that investment opportunity is the primary motive for becoming a homeowner.

Homeownership also has significant upfront costs. Becoming a homeowner entails paying upfront costs, such as realtor, settlement, and lender fees. A household could easily spend 10 percent of

[3] For a good literature review of both the private and public benefits of homeownership, see Dietz and Haurin (2003).

the purchase price on transaction costs. A lower bound estimate would be 3 percent (see Dietz and Haurin, 2003). Given the fixed costs, households for whom owning is a better choice would not expect to move soon after purchasing. The transition to homeownership is associated with expected low mobility and, thus, a higher age, family size, and income.

The dollar value of the reduction in housing costs can be estimated with census data. The average income of households excluded by the Notice is $70,000. For households of this income, the rent-to-income ratio is 14.90 percent, which translates to $10,430 in annual rent payments. Suppose that becoming an owner leads to a reduction in housing cost for a unit of comparable quality. The benefit can be measured as a percentage reduction of the annual rent payments. For example, a sizeable 4-percent reduction leads to $417 annual benefit to households (4 percent x $10,430).

The total value of the annual reduction in housing costs will be affected by the number of years that the benefit is denied and by the discount rate. We assume that the effect of denying the opportunity of an FHA loan to the population in question will be to delay homeownership. As the length of the delay increases, so does the loss in consumer benefits. With higher discount rates, the present values of future years are reduced and thus the private opportunity cost of delay is diminished. Households that find the transition to homeownership a beneficial decision will work to repair their credit score. Most of the negatives will be removed from a credit report after 7 years, and it is possible to increase credit scores significantly after 3 years by better managing consumer debt. A reasonable outside estimate of the number of years homeownership would be delayed is 5 years. We choose 3 percent as our default discount rate given the similarity of that rate to what was used in the FHA actuarial model. This calculation is shown in exhibit 3, column 2.

The size of the rental externality also plays a role. It can be seen as the difference between the sum of the depreciation and maintenance rates of rental housing and owner-occupied housing. Conventional wisdom among lenders is that households should budget from 1 to 3 percent of the original purchase price for annual maintenance to prevent significant depreciation.[4] If the rental depreciation rate were twice that of owner-occupied housing, the range for rental housing maintenance costs would be 2 to 6 percent, making 4 percent a plausible outside estimate of the size of the rental externality. Given the annual benefit of $417 (based on an externality of 4 percent), a delay of 5 years, and a discount rate of 3 percent, the present value of the loss would be $1,922.

Although the argument of Henderson and Ioannides (1983) has great theoretical validity, not much empirical work supports the claim that renters pay more than homeowners for constant-quality housing. Evidence exists, however, that rental housing does depreciate at a greater rate than owner-occupied housing. Iwata and Yamaga (2004) estimated the probability of a house being in "sound" condition, depending on whether it was owner-occupied housing, tenant-occupied housing, or landlord-owned housing. They found that the probability of a house being in sound condition decreases by 6 percent if a house is landlord-owned housing compared with owner-occupied housing. Wang, Grissom, and Webb (1991) estimated the price difference of a single-family home, depending on whether it was renter occupied or owner occupied. If the house had been a rental property, its selling price would have decreased by $2,428, which is approximating 3.7 percent of

[4] See Riha (2010).

the price of a "standard house." This 3.7-percent decline in value is roughly equal to our estimate of the rental externality derived using assumptions concerning the differences in maintenance and depreciation rates. Shilling, Sirmans, and Dombrow (1991) found that renter-occupied housing depreciates 1.9 percent more each year than owner-occupied housing. Using repeat sales data, Gatzlaff and Green (1998) found that the difference is very small, only 0.16 percent. This negligible difference in housing value may reflect that landlords are using the additional revenue collected through the rental externality to invest in their property.

The reduction in housing costs through homeownership is considered a benefit to society because the source of the reduction is a decline in the cost of supplying the housing. If it were only a transfer between consumers (renters who become homeowners) and producers (landlords), then the transition to homeownership would represent a zero-sum gain for society. A social gain exists, however, because the removal of the rental externality is equivalent to a reduction in the cost of supplying housing services for the household that made the transition to ownership. Landlords charge a rental premium to compensate them for the damage that occurs to their property given the incentives that renters face. Transition to homeownership changes those incentives and generates net benefits for society.

A final and important point to make concerning consumer benefits is that not all borrowers excluded by the Notice would have realized the benefits of homeownership. Some of those who receive a loan will default and be foreclosed upon. To accurately measure the private benefits of homeownership, we need to account for the chance that not all households who become owners will remain owners. The probability that a homeownership will survive until a specific year without a foreclosure is equivalent to 1 less the probability that the household will not be foreclosed upon, or the cumulative claim rate for that year. Cumulative claim rates increase over time with the greatest increase occurring in the third or fourth year, yielding an S-shaped survival curve. Using the cumulative claim rates for the excluded group in the fifth year of approximately 11.1 percent, the estimate of the expected private loss is $1,709 per household (88.9 percent x $1,922).

Public Benefits of Homeownership

A third approach to measuring the advantages of an FHA loan would be to evaluate the social benefits of a household becoming a homeowner. The traditional argument for homeownership is that a homeowner will invest more in his or her community because a financial incentive exists to improve the quality of the neighborhood and thus home values. Maintaining properties will also have positive spillover effects to neighboring property values. In addition, an engagement by homeowners will lead to greater political activity, a more amenable urban environment, and less crime. A literature exists that also links housing tenure with child outcomes (health and education). One negative social effect of homeownership is reduced mobility, which leads to rigidity in the labor market and thus lengthens economic downturns.

This type of empirical research has some obvious methodological challenges. Disentangling the explanatory variable (tenure status) with other characteristics of the household is difficult when the path to ownership depends on credit score, which depends on the stability and thrift of the household. Strong empirical evidence has been found, however, for the positive effect on child outcomes, political activity, and wealth accumulation and for the negative effect on mobility.

Homeownership seems to have both social costs and benefits, and the empirical evidence for some of the most compelling arguments for encouraging homeownership is weak. A new wave of empirical research has generated much more modest estimates of the social value of homeownership. For the sake of argument, however, we choose one study by Coulson and Li (2010) that does not focus on the cause of the benefits but produces an empirically rigorous estimate of the impact of adding a homeowner to a neighborhood.

Coulson and Li (2010) used data from the American Housing Survey and analyzed housing clusters that included between 6 and 16 single-family homes. They found that a 100-percent increase in the homeownership rate in a cluster raises the price of a housing unit by 40 to 50 percent. In one example, they calculated that the transition of an additional unit would raise the value of other units by 4.1 percent. If the average price per unit is $170,000, this calculation signifies an increase of $6,970 per unit. Therefore, the externality benefit of ownership for the rest of the typical cluster of 9 homes is $62,370 (9 x $6,970). The value of 1 year of public benefits is the discount rate times the total stream of benefits, or $1,882 (3 percent x $62,370). The opportunity cost to the public of preventing transition to homeownership is the loss of the present value of the stream of public externalities. If a household's transition were delayed for 5 years, the present value of the stream of lost public benefits would be $8,673 (at a 3-percent discount rate and $1,882 annually) as shown in exhibit 3.

The expected loss from delay is equal to the dollar amount of the lost benefit times the probability that the household would remain as owner occupants. This probability is equal to 1 less the cumulative claim rate. With a delay of 5 years, the expected loss from delay would be $7,711. As shown in exhibit 3, the sum of the private and public costs is $10,595 and the expected total cost is $9,419.

In the previous estimate of the expected cost to society of excluding a household from homeownership, we assume that the only effect of excluding a household is the denial of the benefits of homeownership. We did not account for the possible social costs of foreclosure for every homeowner created. Sizeable losses exist, however, from a foreclosure borne by consumers, lenders, property markets, and local governments. An estimate of the deadweight losses (social costs)

Exhibit 3

Net Expected Opportunity Cost of Delaying Households From Transition to Homeownership (3-Percent Discount Rate)

Delay in Years	(1) Claim Rate (Cum.)	(2) Private Cost of Delay (2)+(3) ($)	(3) Public Cost of Delay ($)	(4) Total Cost of Delay ($)	(5) Expected Cost of Delay (1-(1))x(4) ($)	(6) Cost of Foreclosure ($)	(7) Expected Cost of Foreclosure ($)	(8) Net Expected Cost of Delay (5)-(7) ($)
1	0.14	417	1,882	2,299	2,296	52,190	72	2,224
2	1.88	810	3,656	4,466	4,382	49,194	929	3,453
3	5.60	1,192	5,378	6,570	6,201	47,761	2,743	3,458
4	8.61	1,562	7,050	8,612	7,870	46,370	4,221	3,649
5	11.1	1,922	8,673	10,595	9,419	45,020	5,446	3,974
6	13.1	2,271	10,249	12,521	10,879	43,708	6,436	4,442
7	14.6	2,610	11,780	14,390	12,284	42,435	7,178	5,106

from a foreclosure would include transaction costs, the distress discount on the property, and the negative effect on the value of surrounding properties.

To calculate transaction costs, we sum broker and legal fees. Broker fees are 6 percent of the property value ($10,200 = 6 percent x $170,000) and legal fees are 2 percent of the loan value ($2,720 = 2 percent x $136,000, assuming an 80-percent LTV ratio). Total transaction costs are $12,920.

The reduction in property value from the investor being forced to sell a home because it is foreclosed upon (stress discount) is a second source of deadweight loss. It is not obvious, however, whether the stress discount should be counted as a cost rather than a transfer. Although the seller will lose from a reduction of property value, the buyer may gain from the opportunity to purchase at a lower price. Pennington-Cross (2006) found that Real Estate Owned (REO) properties suffer a 22-percentage point discount in appreciation rates compared with the metropolitan average appreciation rates. Union Bank of Switzerland (UBS, 2008) uses a stress factor of 15 percent to estimate the additional decrease in value from selling a foreclosed property. One obvious explanation for this result is one of reverse causation; a default may occur because appreciation in a particular submarket lags behind the metropolitan average. Negative price appreciation may result in rational default by the borrower once the value of the loan exceeds the value of the home.

Two other theoretical explanations for this empirical result provide insights into economic behavior. The first explanation is the possibility that in an environment of asymmetric information a foreclosure is a signal of a "lemon" property, in which case the buyer is compensated through a lower purchase price for taking a risk. A second explanation of the stress discount to the values of foreclosed homes involves behavior that creates a deadweight loss to society. Frequently, before owners sell a home, they invest a great deal into the structure, at least into the cosmetic aspects of the property. An owner who knows that he or she will default will cease to maintain and upgrade the property and may even actively disinvest (sell appliances or fixtures, for example). The depreciation to the property is structural and real; the new owner must invest resources to restore the property to its preforeclosure state. Harding et al. (2000) found evidence of this externality: borrowers with high LTV ratios spend, on average, 19 percent less on maintenance than those with lower LTV ratios. Knowledge of impending default would increase the overuse of housing. We assume that this structural damage is equivalent to the entire value of the UBS estimate of the stress discount on the property, which yields $25,500 (15 percent x $170,000).

Foreclosures resulting in long-term vacancies have a negative effect on the value of neighboring properties by reducing the physical appearance of the neighborhood, attracting crime, and depressing the local economy. The study of Immergluck and Smith (2006) reports a reduction of 0.9 percent of value for all properties within one-eighth of a mile. One approach to using the results from this literature would be to limit the negative externalities to close neighbors (ones directly adjacent and across from the foreclosed property: two on each side of the property and five across the street). Doing so would limit the aggregate effect to $13,770 (0.9 percent x $170,000 x 9).

The total social cost per foreclosure would be $52,190 ($12,920 + $25,500 + $13,770). The expected social cost of foreclosure is the sum divided by the length of the delay of the probabilities of a foreclosure occurring in a particular year (the conditional claim rate) times the discounted value of the social cost of the foreclosure. With our assumed cumulative claim rates, a delay of

5 years, and a discount rate of 3 percent, the expected social cost of a foreclosure is $5,446. As shown in exhibit 3, column 8, the net expected cost of excluding a borrower is thus: (1 – probability of foreclosure) x opportunity cost of preventing ownership + probability of foreclosure x cost of foreclosure. With a 5-year delay, the net expected cost of excluding a borrower is $3,974.

Transfers to FHA

When FHA tightens its underwriting guidelines, it will reduce the net claim expense associated with loans for which delinquency leads to an insurance claim. HUD bases its proforma budget accounting on forecasts of claim and prepayment rates calculated using the forecasting model from the independent actuarial study of the MMIF (IFE, 2009), but using the economic projections of the President's Budget. The actuarial models rely on 30 years of actual FHA experience and are calibrated to produce loan-performance outcomes using forecasts of future economic conditions. The following equation represents the expected net claim expense associated with any given loan, in any given year:

Expected claim amount = claim rate x (loss rate x unpaid loan balance).

The claim rate is the number of claims during a particular time period divided by the total number of loans endorsed when an annual insurance cohort was underwritten. For the FY 2011 cohort, the most recent budget forecasts a 19.63-percent cumulative claim rate. The time trend of the claim rates over 30 years is estimated using the predicted cumulative claim rates from the actuarial review (IFE, 2009: page F-7). The cumulative claim rates from the actuarial review were inflated by a factor of 2.76 to account for the higher claim rate predicted among the higher risk, excluded group (19.63 percent/7.11 percent).

The loss rate is the net loss after property-sale recoveries, as a percentage of the unpaid loan balance on the defaulting loan. Exhibit E-1 of the actuarial review provides a time series of loss rates. The 2000s began with loss rates as low as 32 percent but reached 56 percent by 2008. Current estimates by FHA for the 2011 cohort is that the loss rate on average is 47.64 percent and that the loss rate for the excluded borrowers will be higher at 51.22 percent.

Using recent FHA data, we found that the average loan originated to the group of individuals affected by the Notice is smaller than the global average: $153,000 as opposed to $176,600. Using $150,000 as our default and assuming an interest rate of 6 percent, the annual mortgage payment would be $10,987. The decline in the unpaid balance is slow at first, decreasing approximately $2,000 in the first year, because mortgage payments consist of primarily interest at the beginning of the repayment; by the end of the loan's 30 years, the decline reaches $10,000.

For example, in the second year, the unpaid balance on the $150,000 loan would be $148,103. The claim amount, therefore, would be $75,858 (51.22 percent x $148,103). Using an annual unconditional claim rate of 1.74 percent,[5] the expected claim amount would be $1,295. The present value of the expected claim paid in the second year would be $1,258 (when the discount rate is approximately 3 percent).[6]

[5] The unconditional claim rate is an annual rate consistent with the annual change in the cumulative claim rate.

[6] The time series of discount rates is those used in the actuarial review.

Next, we summed the present values of the expected claims paid over all years to arrive at an estimate of the expected claim. For our parameters, the expected claim amount is $10,268. We multiplied this amount by the original number of endorsements to arrive at a total across all loans. Whether FHA should expect a gain or loss depends on the mortgage insurance premium income:

Expected loss per loan = expected claim amount – upfront premium – periodic premium income.

The upfront mortgage insurance premium is equal to 2.25 percent of the original loan balance, or $3,375, when the loan balance is $150,000. For LTVs greater than 95 percent, which represent approximately 40 percent of the affected borrowers, the annual premium is 0.55 percent of the unpaid loan balance and is collected until the unpaid balance reaches 78 percent of the original loan amount. In a specific year, the proportion of loans that pays the periodic premium is assumed to be (1 – unconditional claim rate) plus one-half the prepayment rate (to reflect that prepayers would have paid one-half per year). The expected net present value of the premium income (upfront + annual) is $5,777 ($3,375 + $2,402). The net loss per loan to FHA is $4,491.

A reduction of net losses from the subject loans provides a direct benefit to the financial status of the MMIF. Over time, it is also possible that this reduction of FHA losses could lead to benefits to remaining FHA-insured borrowers through lower premium rates. The annual aggregate benefits would be approximately $96 million when FHA endorses 1.5 million loans annually and the size of the group affected is 21,300.

Aggregate Impact

When FHA endorses 1.5 million loans and this Notice excludes 21,300 loans, the total transfer to FHA would be $96 million and the (net) cost of excluding the borrowers would be $85 million. To generate an estimate of the net public benefit of the policy change would also entail attaching a value to the qualitative argument concerning the public benefit of FHA in providing liquidity. The aggregate impacts of the program in the base case are summarized in exhibit 4 below.

Exhibit 4

Costs and Benefits of Notice

Per-Loan Transfer—Avoided FHA Loss		
(1) Expected claim	$10,268	
(2) Premium income	$5,777	
(3) Expected FHA gain	$4,491	(1) – (2)
Per-Loan Cost—Cost of Delaying Transition to Ownership		
(4) Expected total cost	$9,419	
(5) Expected cost of foreclosure	$5,446	
(6) Expected net costs	$3,974	(4) – (5)
Total Costs and Benefits		
(7) Loans endorsed in year 1	1.5 million	
(8) Loans affected by the Notice	21,300	0.0142 x (8)
(9) FHA losses avoided	$96 million	(3) x (8)
(10) Costs of exclusion	$85 million	(6) x (8)

FHA = Federal Housing Administration.

Sensitivity Analysis

A sensitivity analysis is merited because the parameters of this model are difficult to predict. The number of loans endorsed, average amount of the loan, loss rate, claim rate, and capitalization rate all are subject to trends in the real estate and credit markets. The number of loans endorsed does not affect the per-loan net benefits, but it will affect the aggregate costs and benefits proportionally. In exhibit 5, the aggregate costs and transfers are shown for different numbers of loans affected by the rule. The number could vary for two reasons: (1) total endorsements vary or (2) the proportion of riskier loans varies. For example, when the Notice was first considered, low FICO (credit-scoring model) and high LTV borrowers constituted a greater share of FHA borrowers than they do now. It is difficult, however, to predict trends in credit scores. We used the scenario of 21,300 loans excluded throughout the analysis. It is reasonable to assume that loans of those characteristics would be 50 percent lesser or higher in volume.

Exhibit 5

Aggregate Costs and Transfers of the Notice by Loan Endorsements

Loans affected	14,200	21,300	28,400
Transfer to FHA	$64 million	$96 million	$144 million
Costs-surplus lost	$57 million	$85 million	$127 million

FHA = Federal Housing Administration.

Alternatives Considered

As mentioned previously, this Notice is only one approach to restoring the MMIF capital reserve account. To a large extent, many of the alternative policies are currently being pursued. This Notice is focused on riskier borrowers. One way in which this particular Notice could vary is by the stringency of the underwriting standards. Consider, for example, a Notice that excluded borrowers with a FICO score below 620, a floor that is commonly used by private lenders. There are three parameter changes from this alternative. The first is the number of loans affected (9.26 versus 1.42 percent of all loans endorsed); the second is the cumulative claim rate, which would be slightly lower; and the third is the loan size, which would be higher—$159,000 as opposed to $153,000. The net effect is that the transfer per loan of the alternative drops by approximately $1,000 to $3,336. In addition, the average social cost of excluding a borrower rises by approximately $900.

The change in the claim rates will affect whether the net benefit per loan is positive or negative, the size of loan will affect the size of the transfer benefit per loan, and the number of loans will affect the aggregate impact of the Notice. The lower claim rates lead to a lower transfer to FHA—$3,336 as opposed to the base case estimate of $4,491 of this Notice. Although the aggregate transfer to FHA would be greater ($460 million) because of the higher number of loans, so would be the aggregate net expected cost of delaying homeownership ($668 million). Furthermore, the portion of loans excluded under this alternative would be disproportionately composed of borrowers belonging to protected classes under the Fair Housing Act of 1968.

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