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An examination of geographic heterogeneity in price effects of superfund site remediation

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HIGHLIGHTS

- We test if hedonic price impacts of Superfund cleanup are consistent between cities.
- Total effects are similar across cities, but prices appreciate at different stages.
- This suggests more research into the particular disamenities of Superfund sites.

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ABSTRACT

This paper investigates heterogeneity in housing market reactions to Superfund site remediation using housing transaction spanning four Metropolitan Statistical Areas. Local housing price effects for site status changes in the Superfund program are estimated and allowed to vary by geography. Total price effects appear to be consistent across the country, but prices appreciate at a different stage of cleanup in Philadelphia than in other sample cities.

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1. Introduction

United States hazardous waste remediation costs have risen over the last decade as the United States Environmental Protection Agency (EPA) continues to add hazardous waste sites to its flagship remediation program, popularly known as the "Superfund". A recent study by the United States Government Accountability Office found that the projected costs of EPA's obligations in the Superfund program, $335 to $681 million per year, greatly outstrip the funding available for those activities, $220 to $267 million per year (U.S. Government Accountability Office, 2010).

A number of economic studies have used hedonic methods to estimate the benefits of Superfund cleanup, however, these studies typically assume that any value of cleanup is constant across cities.[1] In practice, benefits of cleanup could vary spatially, with time, with distance from site, by contaminant type, or by other criteria.[2] We extend Mastromonaco (2014) to test whether the benefits of cleanup vary between cities.

We provide evidence that different stages of cleanup matter in different cities, a direct test which complements the prior meta-analysis of Kiel and Williams (2007). We suggest several explanations, including different contaminant types in different cities. The heterogeneity of price impacts has important implications for policymakers considering prioritizing cleanups, as well as for econometricians trying to understand household behavior or trying to reconcile varying impact estimates in the literature.

2. Data

This study uses detailed housing transactions data and data on Superfund sites in Philadelphia, PA; Miami, FL; Los Angeles, CA; and Minneapolis-St.Paul, MN.[3]

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[1] A recent long, but incomplete, set of examples includes Greenstone and Gallagher (2008), Gamper-Rabindran and Timmins (2013), Mastromonaco (2014), Kiel and Zabel (2001) and Gamper-Rabindran et al. (2011).

[2] Mastromonaco (2014) provides evidence that cleanup benefits have been fairly stable over time.

[3] Ideally, a full examination of regional heterogeneity would include dozens of cities, not just four. Unfortunately, additional cities were not available for this study. The cities represent the four major census regions: Northeast, Midwest, South, and West.

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Table 1
Price effects of remediation.

Old status	New status	Effect
Preproposal	Proposed	γ_1
Proposed	Final listing	$\gamma_2 - \gamma_1$
Final listing	Construction complete	$\gamma_3 - \gamma_2$
Construction complete	Deletion	$\gamma_4 - \gamma_3$

We obtain data on virtually all housing transactions from Dataquick,[4] a private data provider, including home characteristics and transaction dates and prices.[5] While the data include all real estate transactions, we restrict the data to single family houses or condominiums sold at arms length. Furthermore, in an effort to remove "flipped" houses, we remove properties that sold more than once in a year, transactions with a mortgage greater than the transaction price plus $5000, and houses marked as having a major improvement. Lastly, homes that fall in the top or bottom 1% of the distribution of lot size, square footage, bedrooms, and bathrooms are dropped to remove unusual or eccentric properties. The average house in our sample sold for $332,000, was about 3 bedrooms and two bathrooms, and 1600 square feet. Defining "near" as being within three kilometers, less than one percent of homes were near proposed National Priorities List (NPL, aka Superfund) sites, about 7% were near Final NPL sites, 4% near Construction Complete sites, and 3% near sites that were deleted from the NPL. In sum, there are 134 Superfund sites, at various stages of remediation, with housing data in proximity to them. Table 2 provides summary statistics.[6]

Publicly available data from the EPA lists all Superfund sites, including their locations and when they move from one stage of the program to the next. While there are a multitude of individual actions, markers, and milestones that a site proceeds through in the Superfund Program, we have chosen to focus on four: Proposal to the NPL, Final listing on the NPL, Construction of the remedy ("Construction Complete"), and Deletion from the NPL. These are considered "major" actions in the program and, importantly, are likely to convey distinct information to the public about the fate and status of the site. When a site is proposed to the NPL, this is a formal acknowledgment of the severity of the contamination at the site, done after a preliminary investigation and site assessment. Final listing on the NPL could signal to the housing market that the disamenity will be removed or serve to reinforce the severity of contamination, or both. Designating a site as "Construction Complete" communicates to the housing market that the contamination has been contained and that the mechanism to completely remediate the site is in place. Deletion from the NPL signals that the remedy was successful and monitoring of the site has been finished. Fig. 1 provides a map of Superfund sites across our sample cities. In our first year of data in each city, there are a total of 2 Proposed sites, 70 sites with Final Listing, 27 sites with Construction Complete, and 19 Deleted sites. In the last year of our study, there are a total of 1 Proposed site, 48 sites with Final Listing, 51 sites with Construction Complete, and 34 Deleted sites.

We balance the regression sample between treated and control observations by Coarsened Exact Matching (Iacus et al., 2012). We match on square feet, bedrooms, bathrooms, rooms and year built, intentionally omitting home prices to avoid inducing bias.[7] We are able to match over 99% of treated observations (observations with

[4] Dataquick has since been acquired by CoreLogic.

[5] Years of available data in each city are: Philadelphia 1997–2012, Miami 1997–2012, Twin Cities 1998–2012, Los Angeles 1988–2012.

[6] This table also includes "preproposed" sites. The EPA becomes aware of potential Superfund sites from a variety of sources, including the general public and state and local agencies. It then conducts a series of assessments, including environmental sampling, before potentially formally proposing a site to the NPL (Gamper-Rabindran et al., 2011).

[7] Appendix B provides results from matching on additional criteria and finds similar results.

Table 2
Housing summary statistics.

	Los Angeles	Miami	Twin Cities	Philadelphia	Total
Price	421,467.8	241,835.1	240,841.3	257,230.8	332,311.7
	(249340.90)	(200634.90)	(139383.00)	(161384.00)	(234338.20)
Bedrooms	2.967	2.486	2.963	3.125	2.854
	(0.88)	(0.90)	(0.91)	(0.75)	(0.91)
Bathrooms	2.143	2.015	2.079	2.117	2.098
	(0.76)	(0.66)	(0.83)	(0.94)	(0.77)
Sq. Footage	1606.7	1491.5	1581.2	1835.1	1603.4
	(639.00)	(649.00)	(696.90)	(799.10)	(679.10)
Year Built	1965.4	1982.5	1971.7	1963.7	1970.5
	(20.65)	(15.63)	(30.70)	(32.25)	(23.80)
Transaction Year	1999.4	2004.6	2005.8	2004.6	2002.1
	(6.99)	(4.17)	(3.59)	(4.05)	(6.30)
Preproposed Sites	0.0101	0.000918	0.00912	0.00279	0.00644
	(0.10)	(0.03)	(0.10)	(0.05)	(0.08)
Proposed NPL Sites	0.00102	0.000216	0.00131	0.00549	0.00143
	(0.03)	(0.01)	(0.04)	(0.07)	(0.04)
Final NPL Sites	0.0779	0.0266	0.0241	0.148	0.0682
	(0.28)	(0.16)	(0.17)	(0.39)	(0.27)
Construction Complete Sites	0.00695	0.0457	0.125	0.106	0.0422
	(0.08)	(0.25)	(0.43)	(0.39)	(0.25)
Deleted NPL Sites	0.00295	0.0477	0.0641	0.0848	0.0322
	(0.05)	(0.22)	(0.26)	(0.35)	(0.20)
No. of superfund sites	19	21	28	66	26.79
Observations	1917,794	1083,397	363,129	529,365	3893,685

Notes: Means are reported with standard deviations in parentheses below. Prices have been deflated to January 2010 dollars using a Bureau of Labor Statistics housing inflation index specific to each city. Site counts represent the fraction of observations within three kilometers of a site of the given type. A hazardous waste site is considered a "Superfund Site" if it has been at least proposed to the National Priorities List. The "Preproposed" variable counts the number of sites near a housing transaction for those sites who have not yet been proposed to the NPL, but will eventually be proposed.

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