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THE EFFECT OF JOINT AND SEVERAL LIABILITY UNDER SUPERFUND ON BROWNFIELDS

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ABSTRACT

In response to claims that the threat of Superfund liability deters the acquisition of potentially contaminated sites or "brownfields" for redevelopment, the federal government and the states have enacted laws or adopted programs to protect purchasers from liability. This protection may be unwarranted, however, if sellers can simply adjust the price of contaminated property downward to compensate buyers for the liabilities associated with the property. We present a formal model of joint and several liability under Superfund that allows us to distinguish four different reasons that Superfund liability may discourage the purchase of contaminated property despite the tendency for land prices to reflect the expected transfer of liability to the buyer. The previous literature has overlooked the four effects that we identify, which all arise because a sale may increase the number of defendants in a suit to recover cleanup costs. First, a sale may increase the share of liability that a seller and a buyer may expect to pay as a group. Second, a sale may increase the amount of damages that the government can expect to recover from the defendants at trial. Third, a sale may increase the total litigation costs that a buyer and a seller may face as a group. Fourth, game theory suggests that a sale may increase the amount that the government can expect to extract from defendants in a settlement.

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THE EFFECT OF JOINT AND SEVERAL LIABILITY UNDER SUPERFUND ON BROWNFIELDS

HOWARD F. CHANG and HILARY SIGMAN[*]

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA),[1] also known as the federal Superfund statute, makes certain specified parties potentially responsible for the costs of cleaning up a contaminated site. These potentially responsible parties (PRPs) may include the current owners of such a site, generators and transporters of hazardous waste, and certain prior owners of the site.[2] Courts have interpreted CERCLA to impose joint and several liability on these PRPs for any indivisible harm caused by hazardous substances at the site.[3] Joint and several liability allows the government to recover the full costs of cleanup at the site from any PRP, regardless of the PRP's equitable share of the liability.

Many commercial real estate developers and observers claim that the threat of Superfund liability deters the acquisition of potentially contaminated sites for redevelopment. This claim has stirred concerns about "brownfield" sites, which CERCLA defines as "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."[4] Many communities seek to

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[1] 42 U.S.C. §§ 9601-75 (2000).

[2] See *id.* § 9607(a).

[3] See, e.g., United States v. Alcan Aluminum Corp., 964 F.2d 252, 268-69 (3d Cir. 1992); O'Neil v. Picillo, 883 F.2d 176, 178-79 (1st Cir. 1989), cert. denied, 493 U.S. 1071 (1990); United States v. Monsanto Co., 858 F.2d 160, 171-73 (4th Cir. 1988), cert. denied, 490 U.S. 1106 (1989); United States v. Bliss, 667 F. Supp. 1298, 1312-13 (E.D. Mo. 1987); United States v. Ottati & Goss, Inc., 630 F. Supp. 1361, 1395-96 (D.N.H. 1985); United States v. Chem-Dyne Corp., 572 F. Supp. 802, 810-11 (S.D. Ohio 1983).

[4] 42 U.S.C.A. § 9601(39)(A) (West Supp. 2005).

encourage the redevelopment of these "brownfields" because these sites are considered not only sources of urban blight but also substitutes for the introduction of new industrial sites in suburban rural locations, sometimes known as "greenfields." The use of greenfields would reduce open space, contribute to suburban sprawl, and require construction of new infrastructure.

A U.S. Conference of Mayors (USCM) survey found 95,000 acres of brownfields in 192 responding cities.[5] The USCM survey respondents listed "liability issues" as second only to "lack of clean up funds" as an obstacle to the redevelopment of these sites.[6] Similarly, a recent survey of private developers indicated that they consider protection from liability for cleanup costs to be a valuable incentive to buy and to develop contaminated sites.[7]

Responding to the problem of brownfields, the U.S. Environmental Protection Agency (EPA), local communities, and developers have explored various ways to encourage the redevelopment of these sites.[8] In 1995, the EPA announced that it would issue more "comfort letters" to assure owners engaged in cleanups that the EPA would not subject their properties to further CERCLA actions.[9] As part of its brownfields initiative, the EPA also sought to expand the use of "prospective purchaser agreements," whereby a prospective purchaser and the EPA enter a binding contract that includes a

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[5] See 4 U.S. Conference of Mayors, Recycling America's Land: A National Report on Brownfields Redevelopment 12 (2003).

[6] See *id.* at 14.

[7] See Kris Wernstedt, et al., The Brownfields Phenomenon: Much Ado about Something or the Timing of the Shrewd? 17 (Resources for the Future Discussion Paper No. 04-46, 2004); Kris Wernstedt & Peter B. Meyer, What Do Developers Want?, BrownfieldNews, June 2005, at 12.

[8] "Brownfields," according to the EPA definition, "are abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination." Office of Enforcement & Compliance Assurance, U.S. Envtl. Protection Agency, Policy Toward Owners of Property Containing Contaminated Aquifers 1 (1995).

[9] Robert V. Percival, et al., Environmental Regulation: Law, Science, and Policy 269 (4th ed. 2003); Zygmunt J.B. Plater et al., Environmental Law and Policy 1018 (3d ed. 2004); Timothy Noah, EPA Plans Rules to Limit Liability of Superfund Sites, Wall St. J., Jan. 26, 1995, at A5.

"covenant not to sue" the prospective purchaser under CERCLA.[10] Under such an agreement, the government agrees not to sue the purchaser for any existing contamination in exchange for "adequate consideration," such as reimbursement of cleanup costs or the performance of specified cleanup work by the prospective purchaser.[11] The EPA announced that it would consider such agreements if they would provide a "substantial" benefit, including "a payment for cleanup or a commitment to perform a response action" or benefits to the local community "through the creation or retention of jobs, productive use of abandoned property, or revitalization of blighted areas."[12]

In 2002, the Small Business Liability Relief and Brownfields Revitalization Act[13] amended the Superfund law to exempt a "bona fide prospective purchaser" from liability as an "owner" under CERCLA as long as the purchaser "does not impede the performance of a response action or natural resource restoration" at the site.[14] Purchasers are exempt from this liability if they meet certain specified conditions. The definition of "bona fide prospective purchaser," for example, requires the purchaser to show that all disposal of hazardous substances at the site took place before the purchaser acquired the property, to undertake "all appropriate inquiries" to discover any contamination, to exercise "appropriate care" with respect to hazardous substances found at the site by taking "reasonable steps" to stop any continuing release of those substances and to prevent any future release, and to provide "full cooperation" with the government or other persons conducting "response actions."[15] The legislation also creates a program of federal grants to states and local communities for "assessment," "remediation," and

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[10] Announcement and Publication of Guidance on Agreements with Prospective Purchasers of Contaminated Property and Model Prospective Purchaser Agreement, 60 Fed. Reg. 34,792 (1995).

[11] *Id.* at 34,794.

[12] *Id.* at 34,792-93.

[13] Pub. L. No. 107-118, 115 Stat. 2356 (2002).

[14] 42 U.S.C.A. § 9607(r) (West Supp. 2005).

[15] *Id.* § 9601(40).

"revitalization" of brownfields.[16] Despite all these measures, some critics remain dissatisfied with Superfund liability.[17]

Moreover, each state has its own laws governing the cleanup of contaminated sites in addition to the federal Superfund law. Many state rules mimic the CERCLA liability provisions, including joint and several liability for owners and a broad set of other parties, but some states use different rules.[18] Most states also have their own brownfields programs, which offer various incentives for prospective purchasers and developers, including "comfort" or "no further action" letters and covenants not to sue.[19] Thus, an analysis of the effects of the federal Superfund regime provides not only the basis for an evaluation of federal law but also some guidance for states considering whether to emulate the laws and policies adopted by the federal government.

Superfund liability may well inhibit the development of contaminated property by discouraging buyers from purchasing these sites, but the reasons for such an effect are more subtle than they might first appear. After all, if the liability rules merely forced the buyer to accept some share of a fixed expected liability that they would otherwise impose on the seller, then they would not deter a developer from buying the property as long as that transaction would efficiently transfer the property to the party that would produce greater value from the property. The parties would simply adjust the price of the property downward to reflect the transfer of liability from seller to buyer, and this discount would ensure that economically efficient transactions go forward in spite of this transfer of liability.

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[16] *Id.* § 9604(k).

[17] See Mark Reisch, Resources, Science & Indus. Div., Congressional Research Serv., Brownfields and Superfund Issues in the 108th Congress (2004).

[18] See Environmental Law Inst., An Analysis of State Superfund Programs: 50-State Study, 2001 Update 32-33 (2002); Elizabeth Glass Geltman, Recycling Land: Encouraging the Redevelopment of Contaminated Property, Nat. Resources & Env't, Spring 1996, at 3, 4-5.

[19] Geltman, *supra* note 18, at 9; see Environmental Law Inst., *supra* note 18, at 41-43; Plater et al., *supra* note 9, at 1019-20; Charles Bartsch & Rachel Deane. Brownfields State of the States: An End-of-Session Review of Initiatives and Program Impacts in the 50 States (5th ed. 2002).

In Section I of this paper, we survey theories proposed in the previous economic literature suggesting how environmental liability may discourage the redevelopment of contaminated sites despite the tendency for land prices to compensate buyers for the liabilities associated with the property. In Section II of this paper, we present a formal model of joint and several liability under Superfund and advance four different reasons for this Superfund liability to discourage the purchase of contaminated property. The previous literature has overlooked the four effects that we identify, which all arise because the purchase may increase the number of defendants in a suit to recover cleanup costs. First, a sale may increase the share of liability that a seller and a buyer may expect to pay as a group. Second, a sale may increase the amount of damages that the government can expect to recover from the PRPs at trial. Third, a sale may increase the total litigation costs that a buyer and a seller may face as a group. Fourth, game theory suggests that a sale may increase the amount that the government can expect to extract from PRPs in a settlement. In Section III of this paper, we conclude with a discussion of the implications of our analysis for law and public policy.

I. PREVIOUS LITERATURE

Economists have recognized that land prices may include discounts reflecting environmental liability for cleanup of contaminated property. Thus, this liability need not affect the incentives for developers to buy these sites. The previous economic literature identifies some possible reasons that a transfer of liability to a party buying contaminated property may nevertheless discourage efficient transactions.

First, Kathleen Segerson (1993) notes that if the buyer and the seller are not equally likely to be judgment-proof, then a transfer of liability would distort incentives to transfer the property from buyer to seller.[20] Liability would create too great an incentive to transfer the property to prospective buyers that are more likely to be judgment-proof than the current owner and too little incentive to transfer the property to prospective buyers that are less likely to be judgment-proof than the current owner. If the prospective buyer is less likely to be judgment-proof than the current owner, then the proposed sale would

[20] See Kathleen Segerson, Liability Transfers: An Economic Assessment of Buyer and Lender Liability, 25 J. Envtl. Econ. & Mgmt. S-46 (1993).

impose a greater expected liability cost on the buyer than the reduction in the expected liability cost for the seller, and no price reduction could compensate the buyer without imposing a net cost on the seller for the transaction. This net cost could discourage efficient transactions and redevelopment of contaminated property.

Second, James Boyd, Winston Harrington, and Molly Macauley (1996) note that if the seller is better informed than the buyer about the environmental condition of the property, then this information asymmetry can create an adverse selection problem that drives high-quality property from the market.[21] Third, they also note that even if the buyer and seller are equally well informed, the government's ability to detect contaminated sites is imperfect, and current owners may keep property off the market to avoid attracting the attention of regulators to contamination at the site.[22] If transactions increase the probability of detection by regulators, then they increase the expected liability costs associated with the property. Once again, no price reduction could compensate the buyer for the liability imposed without also imposing a net cost on the seller for the transaction, which in turn could discourage efficient redevelopment of contaminated property.

This paper identifies four additional reasons that Superfund liability could discourage efficient transactions. Superfund liability may have these effects even if the buyer and seller are equally likely to be judgment-proof and have the same information regarding contamination at the site and even if the transaction has no effect on the probability of detection by regulators. Each effect implies a tendency for the expected costs imposed on the buyer to exceed the reduction in the expected costs enjoyed by the seller. That is, the sale of the property would increase the expected costs for the buyer and the seller taken together. This increase in their collective costs, unlike a mere transfer of liability from the seller to the buyer, could not be offset by an

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[21] See James Boyd, Winston Harrington & Molly K. Macauley, The Effects of Environmental Liability on Industrial Real Estate Development, 12 J. Real Est. Fin. & Econ. 37, 46-47 (1996). Buyers can mitigate this problem by inspecting the site thoroughly before purchasing the property. See Percival et al., *supra* note 9, at 237 (noting that "in the great majority of cases, site assessments generally have little difficulty determining that properties are contaminated").

[22] See Boyd, Harrington & Macauley, *supra* note 21, at 49-52.

adjustment in the sale price and therefore would inhibit sales of contaminated properties.

All of the barriers to efficient transactions that we identify flow from the following feature of Superfund liability: If a PRP that owned the site "at the time of disposal of any hazardous substance" sells the property, then under CERCLA, after such a sale, both the buyer and the seller are PRPs.[23] That is, the number of PRPs that the government can hold jointly and severally liable increases upon such a sale of the property if the buyer was not already a PRP. Furthermore, the law defines "disposal" broadly to include "the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water."[24] Given this broad definition of "disposal," some courts have held prior owners liable even if they engaged in no active disposal themselves if they owned the land while wastes previously deposited on the land continued to leak or spill during their ownership.[25] The broader the definition of "disposal," the more likely courts are to hold prior owners liable as PRPs, and the more likely each sale of the property is to increase the number of PRPs.

Unlike the effects that we identify, the effects identified in the previous literature would occur even if the seller could protect itself from all liability through a sale of the property and transferred all liability to the buyer. Furthermore, all of the effects that we identify are associated with the joint and several liability imposed by Superfund, whereas the qualitative effects

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[23] 42 U.S.C. § 9607(a)(2) (2000).

[24] Solid Waste Disposal Act § 1004, 42 U.S.C.§ 6903(3) (2000); see CERCLA, 42 U.S.C. § 9601(29) (2000) (incorporating the definition from the Solid Waste Disposal Act § 1004 into CERCLA).

[25] See, e.g., Nurad, Inc. v. William E. Hooper & Sons, 966 F.2d 837, 844-46 (4th Cir. 1992) (upholding CERCLA liability for a passive prior owner), cert. denied, 506 U.S. 940 (1992); Carson Harbor Village, Ltd. v. Unocal Corp., 270 F.3d 863, 879-81 (9th Cir. 2001) (holding that "disposal" under CERCLA does not include passive soil migration, but may include other passive migration, such as from leaking barrels or tanks), cert. denied, 535 U.S. 971 (2002). But see United States v. 150 Acres of Land, 204 F.3d 698, 705-06 (6th Cir. 2000) (limiting "disposal" under CERCLA to spills occurring by human intervention); ABB Industrial Sys. v. Prime Tech., Inc., 120 F.3d 351, 357-59 (2d Cir. 1997) (rejecting CERCLA liability for a passive prior owner); United States v. CDMG Realty Co., 96 F.3d 706, 713-18 (3d Cir. 1996) (same); United States v. Petersen Sand & Gravel, Inc., 806 F. Supp. 1346, 1350-53 (N.D. Ill. 1992) (same).

identified in the previous literature flow more generally from the transfer of liability to new owners, whether or not this liability is joint. Thus, the effects that we identify have different implications for law and public policy than those identified in the previous literature.

Furthermore, Sigman (2005) presents empirical evidence that joint and several liability in particular inhibits the development of contaminated sites.[26] Those results suggest that joint and several liability reduces land prices and development rates in both central cities and suburbs. This evidence is consistent with the theory presented in this paper.

We will present our theory using a formal model of joint and several liability based on the model we developed in Chang and Sigman (2000).[27] Our model allows us to study the effects of sales of contaminated property because it allows us to vary the number of PRPs at a contaminated site. This model extended the model of joint and several liability developed earlier by Lewis Kornhauser and Richard Revesz (1994), which assumes only two defendants.[28]

II. THEORY

Suppose that the government brings suit under CERCLA against all available PRPs for cleanup costs at a contaminated site. The government litigates against N defendants, where N is an integer and $N \geq 1$. Suppose that all defendants would share liability equally if they litigate and lose at trial. Normalize the amount of damages at stake to equal one, so that if the government were to prevail at trial against all N defendants, for example, each would pay $1/N$. Let p represent the probability that the government prevails against any given defendant, where $0<p<1$.

Suppose the N defendants are divided into m groups, where m is an integer and $1 \leq m \leq N$. The m groups may be of unequal size. Within each group, the

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[26] See Hilary Sigman, Environmental Liability and Redevelopment of Old Industrial Sites (Apr. 2005) (unpublished manuscript, on file with the author).

[27] See Howard F. Chang & Hilary Sigman, Incentives to Settle under Joint and Several Liability: An Empirical Analysis of Superfund Litigation, 29 J. Leg. Stud. 205 (2000).

[28] See Lewis A. Kornhauser & Richard L. Revesz, Multidefendant Settlements: The Impact of Joint and Several Liability, 23 J. Leg. Stud. 41 (1994).

outcomes at trial are perfectly correlated across defendants. Among the m groups, however, the outcomes at trial are independent. Thus, m is a variable that indicates the degree to which the outcomes at trial are independent among the defendants: if m=1, then the outcomes are perfectly correlated among all defendants, but if m=N, then the outcomes are independent among all defendants. In between these polar cases is a range of cases with some mix of correlation and independence.

All parameters are common knowledge, so there is no asymmetric information in this model. We also assume that all defendants can pay the full amount of damages at stake, so no defendant is judgment-proof. Finally, we assume that a sale has no effect on the probability that the government detects contamination at the site. Under these assumptions, according to models in the previous literature, the threat of liability imposed on buyers should not discourage the efficient transfer of contaminated property to new owners.

Nevertheless, in our model, we can distinguish four different reasons that the threat of Superfund liability would discourage sales of contaminated property. Each effect arises when a sale would increase the number of PRPs from which the government can recover cleanup costs. To illustrate the separate contributions of each of these effects of Superfund liability, we will begin with a simple version of the model, then introduce additional complexity one step at a time.

A. Other Liable Defendants

Suppose that N>1, so that the current owner is not the only defendant associated with the site. For simplicity, suppose also that m=1, so that the outcomes at trial are perfectly correlated across all defendants. In this case, the expected liability for each defendant is p/N.

If a sale of the property increases the number of available defendants from N=n to N=n+1 by adding the buyer as a new PRP, then the expected liability of the buyer and the seller taken together increases from p/n to $2p/(n+1)$. Let Δ represent the magnitude of this increase:

$$\Delta = \frac{2p}{n+1} - \frac{p}{n}\,, \tag{1}$$

which we can express as

$$\Delta = \frac{p(n-1)}{n(n+1)}. \tag{2}$$

An inspection of equation (2) confirms that if $n>1$, then this increase is positive.

This increase in expected liability costs for the buyer and the seller as a group will discourage even efficient transactions. This effect arises because the transaction reduces the collective expected liability of PRPs other than the buyer and the seller. Although the collective expected liability of all defendants remains fixed and equal to p, that expected joint liability is now divided among $n+1$ defendants rather than only n.

Given equation (2), we can show that the magnitude of this effect equals zero at $n=1$, is at its greatest at $n=2$ or $n=3$, when $\Delta=p/6$, then declines as n grows larger, approaching zero as n goes to infinity.[29] Thus, this effect is most important if N is small (but greater than one) before the sale. This effect is also large if p is large, that is, if liability is likely. Finally, because we have normalized the amount of damages at stake to equal one, the absolute value of this effect will also be large insofar as the amount of damages at stake is large.

We can relax the assumption that each losing defendant pays its pro rata share of the liability.[30] Insofar as a sale of the property would add another PRP to the site, and as long as this increase in the number of defendants tends to reduce the share of liability paid by the defendants at trial other than the buyer and the seller of the property, the sale would confer an expected benefit external to the two parties to the sale transaction. The seller and buyer can adjust the sales price to shift the expected burden of CERCLA liability between themselves, but no price adjustment can capture the positive

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[29] If we take the derivative of Δ with respect to n, then we can confirm that the continuous function $\Delta(n)$ expressed in equation (2) reaches a unique maximum somewhere between $n=2$ and $n=3$.

[30] Under the Uniform Contribution Among Tortfeasors Act, a defendant that has paid more than a pro rata share of a joint and several liability has a right to contribution from another defendant that has paid less. Unif. Contribution Among Tortfeasors Act § 1(b) (amended 1955), 12 U.L.A. 185, 194 (1996). Under CERCLA, however, courts "may allocate response costs among liable parties" when a private party seeks contribution from other PRPs "using such equitable factors as the court determines are appropriate." 42 U.S.C. § 9613(f)(1) (2000).

externality that the sale produces for third parties that are already PRPs at the site. As long as $N>1$, there will be such third-party beneficiaries, and this transfer of expected value to third parties would tend to inhibit efficient transactions.

B. Independent Outcomes at Trial

If we relax the assumption that outcomes at trial are perfectly correlated across defendants, then we uncover a second reason that joint and several liability under CERCLA can inhibit development of contaminated property. This second effect arises even if the current owner is the only available defendant, so that $N=1$ before any sale of the contaminated site. Thus, we now relax the assumption that $N>1$ and return to the general $N\geq 1$ case. We also relax the assumption that $m=1$, so that the outcomes at trial are not perfectly correlated among all defendants.

Under joint and several liability, the government need only prevail against one defendant to recover in full. That is, the government will receive an amount equal to one unless it fails against each defendant. Against each defendant, the probability of failure is $1-p$. Therefore, the expected value of the damages paid by the defendants as a group and awarded to the government as a judgment at trial, which we denote D, is

$$D = 1 - (1-p)^m, \tag{3}$$

which increases in m. Thus, if a sale of a contaminated site increases m, then the expected joint liability of the PRPs as a group will also increase as the PRPs become a more diverse set of defendants.

Given equation (3), we can take the derivative of D with respect to m and obtain the following equation:

$$D'(m) = -\ln(1-p)(1-p)^m. \tag{4}$$

Given equation (4), we can confirm that this derivative is positive for $0<p<1$, that is, as long as there is some uncertainty about the outcomes at trial.[31] We

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[31] The value of m would have no effect on D, however, if $p=0$ or if $p=1$, that is, if the outcomes are known in advance with certainty. We can see from equation (3) that if $p=0$, then the government would receive no award at trial, regardless of the value of m. Similarly, we

can also see that the magnitude of this effect falls as m grows larger and the set of defendants becomes more diverse. Therefore, this effect would be most important when m is small, that is, when outcomes at trial are highly correlated among defendants before the addition of the new PRP. The absolute value of this effect will also be large when the amount of damages at stake is large.

As long as the outcome at trial for the new owner is not perfectly correlated with the outcome at trial for any of the other PRPs, then the expected joint liability of the PRPs as a group will increase upon sale of the property to a new owner. Given this weak assumption, the government would benefit from an increase in the number of PRPs. Furthermore, joint and several liability would create this effect even if we relax the assumption of independent outcomes at trial among the m groups of defendants and assumed some correlation among outcomes at trial among all defendants instead, as long as the outcome at trial for the new owner is not perfectly correlated with the outcome at trial for any other PRP. The weaker the correlation between the outcome at trial for the new owner and the outcome at trial for the other defendants, however, the more powerful will be the effect of the addition of the new owner as a PRP.

This effect would inhibit sale of the property even if the prospective seller is the only available PRP associated with the site before any sale. In this case, the government enjoys a positive externality as a result of a sale, and this external benefit functions as a tax on the transaction. The parties to the transaction may adjust the sale price to shift the burden of their joint liability between the buyer and seller, but this price adjustment cannot capture the external benefit conferred upon the government.

If $N>1$ even before any sale, then the benefit conferred upon the government would represent an additional effect of Superfund liability discouraging efficient sales. In cases where the new PRP would be found liable at trial while no other defendants are found liable, the government would benefit from having another PRP to sue. In cases where the new PRP would be found liable at trial along with some other defendants, the government would not benefit, but the other defendants would gain from having another defendant with which to share liability. As long as these beneficiaries include defendants other than the prior owner that sold the property to the new PRP, the buyer and the seller as a group would be worse off at trial as a result of the sale. Thus, a sale not only increases the expected joint liability to be paid by

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can also see from equation (3) that if $p=1$, then the government would recover all of its damages at trial, regardless of the value of m.

the PRPs as a group but also increases the share of that expected joint cost that the buyer and the seller as a group may expect to bear. For both reasons, the sale would increase the liability costs that the parties to the sale would expect to pay in subsequent litigation.

C. Litigation Costs

The foregoing analysis did not include litigation costs in the costs that the prospective buyer and seller would anticipate while contemplating a sale of the property. Suppose, for example, that a trial would impose c_d in litigation costs on each defendant, where $c_d>0$. If a sale adds the buyer to the set of defendants without removing the seller from that set, then the litigation costs imposed on the buyer and seller as a group would rise from c_d to $2c_d$ as a result of the sale. The magnitude of this increase equals c_d, so that this effect will be more important when c_d is large, that is, when litigation costs per defendant are large. Like the increase in the expected liability for cleanup costs, this increase in litigation costs for the buyer and the seller as a group would discourage the sale of the property, whether $N=1$ or $N>1$ prior to any sale.

The prospect of litigation would inhibit property sales even if we relax the assumption that the defendants' total litigation costs are proportional to the number of defendants. As long as a sale causes an increase in the collective litigation costs of the buyer and the seller through the addition of another defendant, as seems plausible, then this effect would inhibit such transactions. This increase in litigation costs seems plausible for any regime that makes both the buyer and seller liable, whether or not the liability is joint and several. This increase in litigation costs seems especially likely to be large, however, under regimes of joint and several liability like that imposed by CERCLA, where each defendant may litigate not only the issue of its own liability but also the issue of an equitable apportionment of joint liability among the defendants.

D. Settlements

So far we have assumed that the government would litigate against all defendants rather than settle out of court with any defendants. Once we allow for the possibility of a settlement, we introduce yet another reason for the risk of Superfund liability to inhibit development of contaminated property: an increase in the number of defendants would increase the total amount that the

government could extract in a settlement with the defendants as a group. This effect is not just an implication of the effects we have already discussed: this effect arises whether N=1 or N>1 prior to a sale, whether outcomes at trial are independent or perfectly correlated, and whether litigation is costless or costly for the defendants.

To see this effect, assume settlement negotiations take the form of the following bargaining game. Suppose that the government makes a "take it or leave it" offer to settle for an amount s, where $0 \leq s \leq 1$, with each of the N defendants paying s/N. The defendants receive this offer simultaneously, and each must either accept the offer and pay s/N in a settlement or reject the offer. If some defendants reject the offer, then the government will litigate against all nonsettling defendants.[32] Litigation would impose costs on the parties: c_p on the plaintiff and c_d on each defendant, where $c_p \geq 0$ and $c_d \geq 0$. The defendants respond simultaneously, independently, and non-cooperatively to the plaintiff's settlement offer. All parties are risk neutral, and each seeks to maximize its expected payoff within the constraints of this framework.

Consider a defendant's decision whether to accept such a settlement offer or to litigate instead. It would be a Nash equilibrium for each defendant to accept the offer if each defendant expects litigating against the government alone (after all other defendants have accepted the offer) to yield a lower payoff than paying s/N to the government in a settlement. Assume that if it is a Nash equilibrium for all defendants to accept such an offer, then all defendants will accept this offer.[33] Each defendant would calculate the expected payoff from rejecting an offer to settle for s/N when all other defendants have accepted this offer.

Under CERCLA's "pro tanto" setoff rule, if the other defendants accept the government's settlement offer, then the court reduces the government's claim against the nonsettling defendant by the amount paid by the other defendants

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[32] Like Kornhauser and Revesz, *supra* note 28, at 58 n.45, we assume that the plaintiff can commit itself to litigate against any defendant that rejects such an offer. This assumption seems especially reasonable in the Superfund context, in which the plaintiff (the government) is an extreme example of a repeat player that has much to gain by building a reputation for litigating against nonsettling defendants.

[33] Like Marcel Kahan, The Incentive Effects of Settlements under Joint and Several Liability, 16 Int'l Rev. L. & Econ. 389, 391 (1996), we focus on this Nash equilibrium in order to emphasize the aspects of our model that are most relevant for the incentive effects of settlements under joint and several liability.

in the settlement.[34] Thus, a defendant would take into account the setoff that a court would apply under this rule as a result of the *N*-1 other defendants settling for *s*/*N* per defendant. A court would hold a losing defendant liable for

$$1-(N-1)\frac{s}{N} \tag{5}$$

under this rule.

A defendant rejecting the settlement offer and choosing instead to litigate alone would face a probability of *p* of being held liable for this amount in damages. For each defendant to settle for the amount *s*/*N*,

$$\frac{s}{N} \le p[1-(N-1)\frac{s}{N}]+c_d \tag{6}$$

is a necessary condition. Solving inequality (6) for *s*, we can restate this necessary condition as

$$s \le s_d, \tag{7}$$

where

$$s_d = \frac{N(p+c_d)}{Np+1-p}. \tag{8}$$

The variable s_d represents the maximum amount that the government could extract in a settlement with all defendants.

If we take the derivative of s_d with respect to *N*, we then find that equation (8) implies that

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[34] See 42 U.S.C. § 9613(f)(2) (2000). Daniel Klerman, Settling Multidefendant Lawsuits: The Advantage of Conditional Setoff Rules, 25 J. Legal Stud. 445 (1996), refers to such a setoff rule as an "unconditional" pro tanto setoff rule, because the court applies this setoff without inquiring into whether the settling defendants were actually liable.

$$s_d'(N) = \frac{(p + c_d)(1 - p)}{(Np + 1 - p)^2}. \tag{9}$$

An inspection of equation (9) reveals that this derivative is positive as long as $p<1$, that is, as long as the defendants are not certain to lose at trial.[35] As N increases, the prospect of litigating alone becomes relatively less attractive for a defendant contemplating a settlement offer, and each defendant becomes willing to accept a settlement more favorable to the government.

Equation (9) also reveals circumstances that will make the effect of an increase in N on the settlement amount large. We can see that this derivative is large when N is small, so that the effect of an increase in N on s_d is most important when there are few PRPs from which the government may recover cleanup costs. This derivative is also large if c_d is large, because the government can extract more from each defendant in a settlement if each faces the prospect of large litigation costs if it goes to trial alone. Thus, if the defendants' litigation costs are large, then the effect of an increase in N on s_d is magnified. Finally, the absolute value of this effect will also be large if the amount of damages at stake is large.

Therefore, if a sale of a contaminated site increases the number of PRPs available for the government to sue, then it will increase the maximum amount that the government can extract in a settlement with all defendants. This benefit for the government will function as a tax on sales of contaminated property, which will tend to discourage the development of these sites. This effect can occur whether or not any of the other effects we have discussed are also operating to discourage sales. Note that this effect occurs whether $N=1$ or $N>1$ before the sale, whether $c_d=0$ or $c_d>0$, and whether $m=1$ or $m=N$. Indeed, the value of m does not affect the defendant's decision at all, as each defendant considers the prospect of litigating against the government by itself if it alone rejects the settlement offer, when there would be no other defendants that might lose at trial and share liability.

We do not suggest, however, that an increase in N will invariably reduce the payoff for defendants. In particular, an increase in N may promote settlement rather than litigation and thereby make defendants better off by

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[35] If the defendants are certain to lose at trial, then the government would be able to recover all of its cleanup costs in a settlement, regardless of the number of defendants, so that an increase in N would have no effect.

allowing them to avoid litigation costs. To see how an increase in N may make settlement more likely, note that the government would settle for an amount s rather than litigate only if

$$s \geq s_p, \tag{10}$$

where s_p represents the government's expected payoff from litigating against all N defendants. That is, $s_p = D - c_p$, or:

$$s_p = 1 - (1-p)^m - c_p. \tag{11}$$

Given the inequalities in conditions (7) and (10), in this bargaining game, a settlement for s is possible only if

$$s_p \leq s_d. \tag{12}$$

An increase in N leads to an increase in s_d, which may induce the government to settle rather than litigate. On the other hand, if a sale of the contaminated site also causes m to rise, then s_p will also increase, which may induce the government to litigate rather than settle. Depending on whether the effect on N or the effect on m dominates, the addition of a new PRP may either increase or decrease the probability of settlement. If c_p and c_d are large enough, an increase in the probability of settlement rather than litigation can improve the defendants' expected payoffs enough to offset the increase in s_d.

Given that the government is likely to settle with PRPs at a contaminated site in practice, however, the effect of an increase in s_d is likely to outweigh an increase in the probability of settlement and is therefore likely to reduce defendants' expected payoffs. In any event, given the ambiguous effects of an addition of a new PRP on the probability of settlement, we would generally expect the sale of a contaminated site to reduce the defendants' expected payoffs on balance. Furthermore, if we relax the assumptions of our model, then in any case in which $s_d < s_p$, the government could avoid the obstacle to settlement that flows from joint and several liability and the pro tanto setoff rule by making settlement offers that are contingent on acceptance by all defendants.[36] The possibility of such offers reduces the probability that

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[36] See John J. Donohue III, The Effect of Joint and Several Liability on the Settlement Rate – Mathematical Symmetries and Metaissues about Rational Litigant Behavior: Comment on

settlement negotiations would fail because $s_d < s_p$. For all these reasons, we would expect the addition of a new PRP to make the defendants as a group worse off.

We can relax the assumptions that the government makes a "take it or leave it" settlement offer and that the defendants respond independently without cooperating with one another. A more general model might allow the defendants to exercise some bargaining power in settlement negotiations, so that settlements do not necessarily allow the government to extract the maximum amount possible from the defendants. Instead, we might assume that when $s_p<s_d$, the settlement that emerges from successful negotiations would fall somewhere in the possible settlement range, with the expected value of the settlement amount determined by the parties' relative bargaining power:

$$s = \alpha s_p + (1-\alpha)s_d, \tag{13}$$

where α is a variable reflecting the defendants' relative bargaining power, and $0 \leq \alpha \leq 1$.

Suppose, for example, that with probability α, the defendants make a "take it or leave it" offer to the government, and with probability $1-\alpha$, the government makes a "take it or leave it" offer to the defendants. If the defendants make the offer, we would expect s_p as the settlement amount. If the government makes the offer, we would generally expect s_d instead as the settlement amount.

If α is a fixed parameter, then an increase in N would still lead to an increase in the settlement amount s, which is a weighted average of s_p and s_d, because an increase in N would increase s_d. If the defendants' litigation costs are large, then this effect would be especially significant. Moreover, if the addition of a new PRP also causes m to rise, then s_p would also increase, adding still another reason for the settlement amount s to increase.

Furthermore, if α is a function of N rather than a fixed parameter, then we would generally expect an increase in N to cause α to fall. That is, we would expect the derivative of α with respect to N to be negative:

$$\alpha'(N) < 0. \tag{14}$$

Kornhauser and Revesz, 23 J. Legal Stud. 543, 555-56 (1994).

A larger number of defendants seems likely to reduce the defendants' bargaining power by making cooperation among them in settlement negotiations more difficult. If the defendants' relative bargaining power falls with N, then the resulting settlement in equation (13) would move away from s_p and up toward s_d, thereby reducing the defendants' payoff still more.

For all these reasons, the addition of a new PRP would shift settlements in favor of the government. This transfer of expected value to the government would tend to reduce the expected payoffs to each defendant. This effect would tend to make the buyer and the seller as a group worse off after a sale and thereby discourage the sale of contaminated property, because an adjustment in the sale price could not capture the benefit derived by the government from the sale.

III. CONCLUSION

We distinguish four different reasons for Superfund liability to discourage the purchase of contaminated property. These four effects all arise because a sale may increase the number of defendants in a suit to recover cleanup costs. First, a sale may increase the share of liability that a seller and a buyer may expect to pay as a group. Second, a sale may increase the amount of damages that the government can expect to recover at trial. Third, a sale may increase the total litigation costs that a seller and a buyer may face as a group. Fourth, game theory suggests that a sale may increase the amount that the government can expect to extract in a settlement with the PRPs. These effects may interfere with the efficient redevelopment of contaminated sites.

The effects that we identify suggest some disadvantages associated with joint and several liability under CERCLA. These effects provide some support for efforts to restrict the scope of this joint and several liability. These efforts include, for example, the efforts of the EPA, Congress, and the states to protect purchasers from Superfund liability. By reducing or eliminating the probability that a purchaser would be liable, these policies avoid or mitigate the deleterious effects that the threat of Superfund liability can have on the incentives to buy contaminated property.[37]

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[37] A more general model would allow each defendant to have its own individual probability p_i of losing at trial, where $i = 1, ..., N$. To the extent that a new PRP is unlikely to be held liable, so that its p_i is small, the addition of that PRP would have little effect on the payoffs

Courts may also take the effects that we analyze into account when they consider whether to adopt interpretations of CERCLA that protect sellers rather than buyers from Superfund liability. For example, the effects that we identify militate against a broad interpretation of the term "disposal" in CERCLA's liability provision, which makes prior owners liable as PRPs if they owned the site "at the time of disposal of any hazardous substance." Courts have divided on the appropriate interpretation of "disposal" in this provision, with courts adopting broader interpretations holding a larger class of prior owners liable. The larger the class of prior owners that are liable, the larger the set of owners that will be discouraged by Superfund liability from selling the property. These owners cannot avoid Superfund liability by selling the property (even at a discount) and therefore have diminished incentives to sell, even when such a sale would be efficient.

The effects we identify, however, are only a few of the many considerations to weigh in a more comprehensive analysis of the costs and benefits of these policy alternatives. There are many other reasons militating in favor or against these policies. For example, a broader scope for joint and several liability may affect incentives for the parties to settle out of court, thereby avoiding costly litigation.[38] These rules may also affect incentives for precaution against environmental contamination.[39] Expanding the class of parties from which the government can recover full damages may promote the internalization of negative externalities, especially in the presence of judgment-proof PRPs, which in turn would improve the incentives to reduce

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that we analyze in our model.

[38] See Chang & Sigman, *supra* note 27; Kornhauser & Revesz, *supra* note 28.

[39] See Kahan, *supra* note 33; Lewis A. Kornhauser & Richard L. Revesz, Evaluating the Effects of Alternative Superfund Liability Rules, in Analyzing Superfund: Economics, Science, and Law 115, 116-28 (Richard L. Revesz & Richard B. Stewart eds. 1995); A. Mitchell Polinsky & Daniel L. Rubinfeld, The Deterrent Effects of Settlements and Trials, 8 Int'l Rev. L. & Econ. 109 (1988); Kathryn E. Spier, A Note on Joint and Several Liability: Insolvency, Settlement, and Incentives, 23 J. Legal Stud. 559 (1994); Tom H. Tietenberg, Indivisible Toxic Torts: The Economics of Joint and Several Liability, 65 Land Econ. 305 (1989).

contamination.[40] Finally, joint and several liability under Superfund may also raise issues of fairness.[41] While such a comprehensive normative analysis is beyond the scope of this paper, we hope to inform these debates by contributing to a more complete picture of the effects of Superfund liability on the incentives to develop contaminated property.

Given that restricting the scope of Superfund liability is likely to have both costs and benefits, it may be advantageous to tailor protection from this liability to those circumstances in which the benefits are likely to exceed the costs. This advantage may militate in favor of discretionary relief granted on a case-by-case basis by administrative agencies through "comfort letters" or prospective purchaser agreements rather than exemptions granted by statute. It may be difficult to design statutory exemptions that incorporate all the relevant factors and specify precisely how they all should enter into a decision to grant relief.

In this respect, it is important that our analysis identifies circumstances in which the four distorting effects we identify are most likely to be significant. If the defendants face large litigation costs, for example, the magnitudes of the second and third effects will be large. If the damages at stake are large, then the magnitudes of the first, third, and fourth effects will be large. Perhaps most important, the magnitudes of the first, third, and fourth effects will be large when the number of PRPs is small (although the first effect is absent entirely if the buyer and seller are the only available defendants). Furthermore, the third and fourth effects, which both increase the expected total payment from the PRPs as a group to the government, will have the greatest impact on a buyer and a seller when those PRPs bear a large share of the expected liability, which is also more likely in a case in which the number of PRPs is small. Finally, all these effects are largest when a sale is most likely to increase the number of liable PRPs, that is, when both the buyer and seller are likely to be liable as PRPs after the sale.

These preliminary observations suggest that in deciding whether to grant relief from liability, the government should weigh the risk that the presence of judgment-proof PRPs will prevent full recovery of damages against the risk

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[40] See Kathleen Segerson, Property Transfers and Environmental Pollution: Incentive Effects of Alternative Policies, 70 Land Econ. 261 (1994).

[41] See David B. Spence, Imposing Individual Liability as a Legislative Policy Choice: Holmesian "Intuitions" and Superfund Reform, 93 Nw. U. L. Rev. 389 (1999).

that the prospect of owner liability will deter efficient redevelopment of contaminated property.[42] As we have shown, the application of joint and several liability to owners will discourage the purchase of such sites the most when the number of PRPs that the government can sue is small. If those few PRPs are unlikely to be judgment-proof, then the small number of PRPs should militate in favor of granting either a new owner or a prior owner relief from liability. Indeed, protection from liability may be explicitly conditional on full recovery of cleanup costs from the other PRPs.[43]

Furthermore, the less likely the seller is to be liable as a prior owner after the sale, the less likely a sale is to increase the number of PRPs, and the weaker the case for protecting the buyer from liability. The buyer has a better case for relief from liability when the seller is likely to be liable as a prior owner. Conversely, the case for protecting the prior owner from liability grows weaker as the buyer becomes more likely to enjoy protection from liability.

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[42] In deciding whether to enter a "prospective purchaser agreement," for example, the EPA considers "whether there is likely to be a shortfall in recovery of costs at the site." Announcement and Publication of Guidance on Agreements with Prospective Purchasers of Contaminated Property and Model Prospective Purchaser Agreement, 60 Fed. Reg. 34,792, 34,794 (1995).

[43] When writing a "prospective purchaser agreement," for example, the EPA may "include in the agreement some provision to recoup" the government's "unreimbursed response costs." *Id.* at 34,795. Similarly, the Brownfields Act limits the protection from Superfund liability enjoyed by a "bona fide prospective purchaser" by imposing a lien on the property for "unrecovered response costs incurred by the United States" at the site as long as this "response action" increases the "fair market value" of the property "above the fair market value ... that existed before the response action was initiated." 42 U.S.C.A. § 9607(r)(2)-(3) (West Supp. 2005).

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