

SECURING PROPERTY RIGHTS*

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ABSTRACT

A central challenge in securing property rights is the subversion of justice through legal skill, bribery, or physical force by the strong—the state or its powerful citizens—against the weak. We present evidence that the less educated and poorer citizens in many countries feel their property rights are least secure. We then present a model of a farmer and a mine which can pollute his farm in a jurisdiction where the mine can subvert law enforcement. We show that, in this model, injunctions or other forms of property rules work better than compensation for damage or liability rules. The equivalences of the Coase Theorem break down in realistic ways. The case for injunctions is even stronger when parties can invest in power. Our approach sheds light on several controversies in law and economics, but also applies to practical problems in developing countries, such as low demand for formality, law enforcement under uncertain property rights, and unresolved conflicts between environmental damage and development.

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“The question I have to decide is, whether the appeal to me by the defendant to deprive the plaintiff of his right of way and give him money damages instead, can be entertained. I think it cannot. [If it were,] of course that simply means the Court in every case, at the instance of the rich man, is to compel the poor man to sell him his property at a valuation. ... I am quite satisfied nothing of the kind was ever intended, and that if I acceded to this view ... I should add one more to the number of instances which we have from the days in which the Bible was written until the present moment, in which the man of large possessions has endeavoured to deprive his neighbour, the man with small possessions, of his property, with or without adequate compensation.” (Krehl v. Burrell, 7 Ch.D. 553 [1878])

“The whole point of a property regime is to restrain the strong from resorting to their strength... The weak are no longer vulnerable to unrestrained depredations, and they now have the chance of becoming rich without becoming strong... The only thing that is certain to be certain under property is effective protection of the weak against violent dispossession by the strong, and vice versa” (Duncan Kennedy and Frank Michelman 1980, p. 723).

I. Introduction

Economists since Montesquieu (1748) and Smith (1776) have seen protection of property rights as essential for growth and prosperity.¹ Yet, property in much of the world today remains insecure. Even in the developed world, the risk of trespass of property by hunters or by neighbors’ cattle, or of exposure to dangerous pollution, is a common concern. In the developing world, the land and property of the weaker members of society are vulnerable to outright takings by the stronger ones—be they tribal chiefs, powerful neighbors, or merely men who are more powerful than women (Ali, Deininger and Goldstein 2014; Ali et al. 2014). People everywhere fear expropriation by the state through eminent domain, without just compensation (Munch 1976; Chang 2010; Singh 2012; Somin 2015). In poor countries in particular, mines and industries badly needed for economic development destroy the environment without keeping their promises to abate or paying compensation for damages (Mayorga Alba 2010). At the heart of insecurity of property is the belief that institutions of law and order such as the police and the

¹ For the aggregate evidence in favor of this consensus, see e.g., Barro (1990), De Long and Shleifer (1993), and Acemoglu, Johnson and Robinson (2001). For micro evidence, see Besley (1995), De Soto (2000), Field (2005, 2007), Goldstein and Udry (2008), Dell (2010), and Hornbeck (2010).

courts do not work well and, even when they do work, serve only the powerful and do not protect the weak in conflicts with the strong.

We provide some evidence that such subversion of justice is a major concern of people in developing countries today, just as it was a major challenge throughout history. We then show theoretically that several fundamental challenges of securing property can be understood from this perspective. Using the example of a farm and a mine that can pollute it, we compare the ability of alternative legal rules to generate efficient outcomes. We argue that subversion of justice by the strong creates a strong presumption that injunctions and other stark bright-line rules are a better way to protect property rights than compensation for damages under a liability regime. This case becomes even stronger when parties can invest in power to subvert law enforcement. We apply our analysis to several controversies in law and economics, but also to pressing problems of development, such as low demand for formality, optimal legal rules when property rights are uncertain, and fundamental conflicts between economic development and environmental degradation.

Figure 1, based on surveys of approximately 1,000 households in each of 102 countries by the World Justice Project (WJP, described in more detail in Section 2), illustrates the basic empirical fact that motivates our analysis. It reports, for all sample countries with population above 50 million, aggregating over the surveyed households in each country, responses to the following question. “In your opinion, most judges decide cases according to: (single answer) 1. What the government tells them to do; 2. What powerful private interests tell them to do; 3. What the law says.” As Figure 1 shows, in the median country, over half of respondents think that courts decide cases according to the preferences of private interests and the state rather than the law. That figure is over 80% in Mexico. Judges, according to most respondents, cater to the government and the strong. In Section 2, we present additional empirical support for this finding from the WJP and other sources, looking across countries and across people of different education levels within countries, as well as at some historical evidence.

In a world of uncertain justice, many people fear that the government will take their property without compensation. About 40-50% of WJP respondents in most countries say that it is “unlikely” or “very unlikely” that homeowners will “be fairly compensated by the government” if “the government decides to build a major public works project in your

neighborhood (such as a railway station or a highway), and ... the construction of this public works project requires the demolition of private homes in your community/ neighborhood.”

Relatedly, households in the WJP are asked which outcome is most likely if “the Environmental Protection authority in [their country] notifies an industrial plant that it is polluting a river beyond the legally permitted levels.” Given a choice between “1. The company complies with the law (either voluntarily or through court orders, fines, and other sanctions); 2. The company bribes or influences the authorities to ignore the violation; 3. Absolutely nothing happens,” 36.1% of respondents in the average country choose (1) and 63.9% choose (2) or (3).

The subversion of justice by the strong and by the state suggests a new lens for analyzing legal rules. Perhaps the most basic question is how best to secure property from takings or nuisances such as pollution. This is extensively charted territory, but largely under the assumption that courts enforce the law. Take the case of pollution. Should those who pollute the property of others pay compensation for damages caused to the owner, an approach called “liability rules” in law? Or, alternatively, should property be protected more harshly, through “property rules” that enjoin polluters from acting by shutting them down? Many legal scholars argue that liability rules that make victims whole are more efficient, on the grounds that such rules provide missing “prices” to potential violators (e.g., Cooter 1984; Ayres and Talley 1995; Kaplow and Shavell 1996). When polluters must fairly compensate victims for harm, they will take these costs into account. Yet many societies use injunctions to stop pollution, and even harsher measures such as legally permissible self-defense to stop trespass (Smith 2004). The quotes at the top of the paper suggest that such ways of securing property have strong support, particularly from those who believe that liability rules fail to protect the poor.

In Section 3, we revisit these debates in a model of a farmer and a polluting mine, and compare compensation and injunctions when the mine is powerful and can subvert damage awards by influencing courts. In our model, injunctions and compensation are not equivalent, and the former are more efficient in environments of low law and order (greater subversion). We also examine the role of bargaining in achieving efficiency, and show how standard intuitions change when justice can be subverted. Our analysis explains the dominance of property rules and other harsh measures as the means of securing property rights.

To illustrate our argument, consider the famous example from Coase (1960), in which a railroad passes near a farm, and its trains emit sparks that can set the crops on fire. Suppose it is efficient for the railroad to install safety equipment that stops the sparks. The Coase Theorem holds that regardless of whether the farmer has the right to a fire-free farm, or the railroad has the right to emit sparks, the two will negotiate to the efficient outcome so long as property rights are well defined and *protected*. That is, if the railroad has the right, the farmer will pay it to install the safety equipment; if the farmer has the right, the railroad will install the equipment because of fear of an injunction from a court to stop its operations, or of having to pay damages should its trains set the crops on fire. But what if the railroad can subvert damage awards?

Suppose to begin with the farmer has the right to a safe farm. If he can demand an injunction, the court may be able to verify that the railroad in fact failed to install equipment and stop its operations. But without injunctive relief, if the farmer's right is protected by a liability rule, the railroad may choose not to install safety equipment, and then convince the court that the losses to the farmer from a burnt crop are negligible. The calculation of damages requires an extra burden on the court in addition to checking whether safety equipment was installed, and is thus especially vulnerable to subversion. Injunctions might then work better to protect the farmer's property right than compensation. Suppose alternatively that the railroad has the right to emit sparks. In this case, the Coasian farmer would want to contract with the railroad to install safety equipment. However, if the railroad takes his money but fails to install the safety equipment and then burns his field, he again needs to sue for damages. If the railroad has the power to subvert damage awards, the farmer will collect nothing, and will therefore choose not to contract with the railroad in the first place.

In this example, different legal rules and entitlements are not equivalent, and only injunctions lead to efficiency. Theoretically, this is a straightforward point; we argue that this exception is more relevant for both legal history and the basic problems of law in developing countries than are the benchmark assumptions of the Coase Theorem.

The second question we address using our model is one of investment in power. The possibility of subverting justice creates tremendous incentives to invest in litigation, political influence, corruption, but also weapons for either self-defense or attack. Such investment is nearly universal—courts are almost everywhere regarded as corrupt—but also enormously

wasteful and distortionary. In the case of exploitation of natural resources, it leads to the undermining of institutions known as the “resource curse.” In Section 4, we ask which legal rules discourage more effectively such wasteful investments, and find that the case in favor of injunctions over compensation becomes stronger when influence can be acquired.

Our analysis sheds light on legal history and several prevailing legal rules even in rich countries, but it is particularly relevant for developing countries. In Section 3, we briefly consider a significant problem in development, namely the poor’s lack of demand for legal title and formality more generally. In Section 5, we extend our analysis to a common situation in which it is unclear who actually owns or benefits from the asset suffering damage. We show that injunctions can be useful even in this case, and that sometimes it is efficient to give standing in court to village chiefs or other parties that have little economic interest in the polluted property.

In Section 6, we turn to the problem of specific performance versus damage awards in addressing contract violations. We describe a close parallel between injunctions and specific performance in contracts, and argue that the choice of an optimal regime turns on similar issues of the subversion of justice. In the contract domain, the common-law tradition, current legal doctrine and mainstream legal scholarship all concur on the optimality of damages, which are viewed as enabling efficient breach (Posner 2009). Leftist legal scholars reject this conclusion (Kennedy and Michelman 1980). We show they have a valid point, and use the famous *Peevyhouse* case to illustrate our argument (Maute 1995).

Our analysis relates to several ideas and debates in law and economics. Our argument is similar to those we made earlier that bright-line rules or quantity regulations may be effective because their enforcement is more difficult to subvert (Glaeser and Shleifer 2001, 2002, 2003). Glaeser and Shleifer (2003) argue that the transition from litigation to regulation in the United States was driven by concerns with subversion of justice. We also revisit the famous argument of Calabresi and Melamed (1972) that property rules encourage efficiency-improving bargaining between parties. Kaplow and Shavell (1996) prove that this argument is incorrect when enforcement of liability rules is accurate or at least unbiased. We show, however, that when fact-intensive legal rules are vulnerable to subversion, property rules are in fact more effective in promoting bargaining and restoring efficiency, thus reviving the Calabresi-Melamed claim.

In conclusion, we summarize our arguments on the many applications of the subversion of justice to understanding the evolution of legal rules, but also the challenges of law and order in developing countries. We also present several testable predictions of our model as to which legal rules and approaches to law enforcement work better in which environments. We hope, as well, that our findings have some implications for policy reform.

II. Some Evidence

II.A. Cross-Country Evidence

The World Justice Project is an independent non-profit organization founded by the American Bar Association in 2006 to advance the rule of law around the world. The WJP Rule of Law Index is a quantitative assessment of the rule of law in 102 countries through surveys of both experts and ordinary people. The surveys query respondents about their real experiences and about hypothetical situations, such as cases in which government uses eminent domain. The experts' evidence can be used to describe the overall situation within the country. The responses from ordinary people can help differentiate the experience of the weak and the empowered.

The WJP Rule of Law Index 2015 is based on General Population Polls conducted in 2012, 2013 and 2014. Overall, there were 108,489 ordinary people in the survey: typically 1,000 living in the three largest cities of each country. The Qualified Respondents' Questionnaires were administered between October 2014 and January 2015 to legal professionals in each country. The experts' sample includes over 2,500 surveys, with an average of 25 respondents per country. In this subsection, we briefly present some cross-country evidence on the central premise of this paper: justice is insecure in poor countries, and the poor are disadvantaged in their access to justice.

One of the questions asked in the expert surveys of the WJP is the following. "Based on your experience during the past year with civil cases between private parties decided by trial courts, what percentage of cases reflect the following outcomes: (a) The final decision reflected the judges' honest evaluation of the available evidence and applicable law; (b) The final decision was influenced by undue pressure from one of the parties or was influenced by corruption." Figure 2 shows, as a function of each country's income per capita, the fraction of cases whose decision, according to the experts, was influenced by undue pressure or corruption. The

relationship is extremely strong. While in the richest countries the share hovers around 10%, in the poorer countries it is over 70%. Experts in lower middle income countries clearly do not believe that the law decides civil cases.

Figure 3 presents the results from another expert question on the WJP: “In your opinion, how likely are the following criteria to put a person at a disadvantage before a civil or commercial trial court? The person is: (a) A poor person.” We graph the share of respondents who believe that courts treat the poor fairly as a function of income per capita, and again find that, according to legal experts, the poor are at a much greater disadvantage in lower middle income countries than in rich ones.

Finally, in Figure 4, we present the results from the WJP household survey question of whether a company found by a country’s environmental authority to exceed river pollution limits will do nothing, bribe the authorities to avoid complying, or comply. Figure 4 shows that compliance is extremely unlikely in poor countries, but rises steady with per capita income.

II.B. Individual-Level Evidence

We next turn to WJP evidence from general population surveys, and consider how individuals characterize their interactions with the legal system as a function of their education and home ownership status. The WJP also includes some data on household income, but we stick with education because the data are better (Botero, Ponce and Shleifer 2013). We divide respondents into those that have less than middle school education (the omitted category), those with middle or high school education, those with a college degree, and those with a postgraduate degree. The regressions are estimated on a pooled sample with country fixed effects, so we have up to 100,000 observations.

Table 1 presents the results on a hypothetical taking of land by the government for a public project, where individuals are asked about their beliefs about the fairness of this process. It is very clear that more educated people are more likely to believe that 1) the government would fairly compensate owners for the taking of the land; 2) homeowners would sue if it did not; and 3) courts would provide a fair compensation. We see the same pattern of beliefs again in a general question on whether judges would block an illegal action by the government. The relationships are generally monotonic in the level of education. Even within countries, the better educated feel better protected by the law from takings than the less educated. Likewise,

homeowners feel more likely to have access to justice than those who do not own homes. In this most basic case of the security of property rights, the weakest members of society, across countries, feel least protected by the law.

The last column of Table 1 returns to the environmental question from the household surveys previously considered in Figure 4, but shows instead within country results by education level. As with the questions on government takings, the better educated survey respondents here tend to be more optimistic that a company found to violate environmental standards complies with the law, rather than ignores the finding of violation or bribes officials. Again, higher education goes with greater confidence in the legal system.

Table 2 presents related evidence on contract disputes between private parties. Compared to the less educated respondents, the more educated ones are more likely to have had such a dispute, to have filed a legal claim, and to feel that the process was objective and unbiased when they did file a claim. More generally, better educated respondents are more likely to feel that courts guarantee everyone a fair trial. The evidence again suggests that the poor neither use nor believe in the courts.

II.C. Historical Evidence

Although subversion of justice by the strong is a universal theme in legal and social history, for our purposes we highlight a few critical moments in the evolution of English and American law. Historical legal disputes often centered on the question of whether the king could subvert justice against his mightier subjects, and whether the latter could in turn subvert justice against their weaker brethren. In 1215, the basic document of England's unwritten constitution, the Magna Carta, stipulated that "Earls and barons shall not be amerced except by their peers, and only in accordance with the degree of the offense" (clause 21). This clause was meant to protect the powerful against abuse by the king. Amercements were flexible fines paid originally in exchange for relief from other legal obligations. Despite signing Magna Carta, the king continued to exact abusive fines, but eventually such takings were supplanted by other institutions. When monarchical power waxed under the Tudors and Stuarts, the royally controlled Star Chamber would impose vast fines on wealthy subjects.

The king defended his abuse of his wealthy subjects as protection of the even weaker ones. He justified the royal domination of courts including the Star Chamber as an attempt to

control *embracery*, the subversion of courts by “the over-mighty subject who broke through the net of procedure and controlled juries through his local influence” (Plucknett 1956, p. 676). Such subversion of justice by the magnates, through bribery and intimidation, seems to have been a mainstay of medieval England. It explains fourteenth-century Special Commissions of Oyer and Terminer in which “sums of £200, £400, or even 1000 m. are cited for trespasses where compensation of 20 d. would be fair” (Kaeper 1979, p. 757). Litigants could select their own judges in Oyer and Terminer Commissions, which enabled the nobility to corrupt the judiciary. The era “coincides with the heyday of the retaining of justices and other crown servants by magnates” (Kaeper 1979, p. 751).

Perhaps the clearest example of subversion of justice by the strong comes from enclosures. The 1235 Statute of Merton gave the nobility the right to enclose previously common land. This right was used and abused for another six centuries. Lords could not just evict tenants with recognized legal rights, like copyhold, but “voluntary agreements” could be “concluded by Chancery suits, in which the consenting parties by collusive action sought to enforce inclosure upon those who dissented” (Gonner 1912, p. 51). During and after the mid-eighteenth century, enclosures were more often the result of wealthy landowners’ petitions for Acts of Parliament. These acts empowered local enclosure commissions, “but, since Parliament took no interest in and had no knowledge of the local questions that the commissioners were to settle, they were in fact nominated by the petitioners; which meant that their appointment, even as all the previous proceedings, was in the hands of the great landowners” (Mantoux 1961, p. 168).

In the nineteenth century, both British and American courts favored railroads and factories at the expense of the owners of property that was damaged by pollution or other externalities (Friedman 1985, Horwitz 1992). As discussed in Glaeser and Shleifer (2003), part of the courts’ motivation was ideology, but a large part was enormous power of large corporations, which barely existed in the US prior to the Second Industrial Revolution, to sway courts in their favor through legal talent, political influence, and bribes. This subversion of justice during the Gilded Age became the rallying cry of the progressive movement in the late nineteenth and early twentieth century, which eventually succeeded in replacing litigation with regulation in many spheres of economic life. Several presidential campaigns, culminating in Woodrow Wilson’s 1914 New Freedom program, focused on these concerns. What is remarkable

about this era is the centrality of courts, and their failure to deliver justice, in shaping the political debate as well as major elections.

The challenges of securing property rights are particularly salient in poor countries today, where extractive industries are simultaneously essential for development and a source of major pollution and other environment hazards. From Nigeria, to Russia, to Ecuador, to Thailand and dozens of other countries, the narratives are similar: a local or multinational mining company creates massive environmental damage, including to farmers and local inhabitants, but manages to avoid abatement or compensation by delaying and bribing courts, enlisting the government or even the military to suppress opposition to its activities, and breaking contracts and commitments by corrupting central government bureaucrats. A key message of many analyses is the huge gap between legal rules on the books and their subverted implementation (Mayorga Alba 2010). Our analysis aims precisely to ask whether some rules are harder to subvert, and therefore easier to implement, than others.

III. A Comparison of Injunction and Compensation

In this section, we present our core model of property rights, which includes an owner and a polluter who interferes with her enjoyment of her property. While we focus on pollution externalities for clarity, our arguments also apply to other forms of interference with private property, such as trespass or outright takings (e.g., through eminent domain). The case of pollution in a regime of subversion of justice addresses some key problems of economic development. We zero in on a central question: What is the optimal way of protecting private property? We define optimality to maximize the sum of benefits to the owner and the polluter.

We examine two institutional options: compensation and injunction. If the property owner is entitled to compensation, she can sue the polluter and the justice system will assess the harm she suffered and mandate the payment of damages. Compensation is akin to an ad hoc Pigouvian tax on harm, and is also referred to as a tort regime or liability rule. If instead the owner is entitled to injunctive relief, also known as a property rule, she can demand that the justice system enjoin the polluter from engaging in the activity that causes her harm, independent of a determination of the precise level of harm suffered.

Our fundamental assumption is that establishing whether a violation of the owner's property right occurred is considerably less fact-intensive, and thus less vulnerable to subversion, than assessing precisely the extent of the harm it caused. For example, police are likely to help when an owner complains that boundaries of his property have been crossed. A court or a local administrator would agree with indisputable facts if a farmer shows a picture of sludge being dumped on his land. In contrast, compensation by definition requires a court to establish both a violation and the extent of damages. Establishing a violation of property rights is roughly similar under compensation and injunction. Such a determination may of course itself be subverted when law enforcement is particularly ineffective. In such instances of complete subversion the form of legal rules does not matter: only might makes right. But land boundaries are often known to neighbors and fixed in property registries, so court discretion is limited and subversion less likely. Computing damages, in contrast, provides a court with more discretion, and thus greater ability to declare them minimal. Damages prescribed by a compensation regime are more open to debate and subversion of justice than injunctions.²

III.A. The Model

The owner O owns a property that provides her with baseline utility of u . A potential polluter P can take an action that yields him a benefit b but imposes a cost c on O . A good example is a mine that can dump runoff waste on nearby fields. This cost c is heterogeneous, non-negative, with a minimum value less than b . It will be critical for our analysis that sometimes unmitigated pollution—or for that matter taking—is efficient: some realizations of c are below b . Our model thus accommodates the cases in which pollution or trespass is efficient.

We assume that a fraction ω of polluters are “powerful,” meaning that they can subvert the determination of damages. A high ω corresponds to a low level of law and order in the society. The key comparative statics in our analysis will be on the efficiency of alternative legal

² At least in common-law countries, courts need not only compute the amount of harm, but also select from different doctrinal categories of damages to be applied, jointly or separately: expectation damages, reliance damages, restitution damages, punitive damages, etc. Fuller and Purdue (1936) famously argued for reliance damages in contract disputes, but scholarly debate remains open eighty years later. An injunction regime has the advantage of short-circuiting such discussions.

rules as a function of the level of law and order ω . Owners can also in principle be powerful, and we address that possibility in Section 3.B below.³

In stage 1, the cost of pollution and the power of the polluter are observable to both O and P . With probability β , P can bargain with O to buy her permission to pollute, or to sell her his promise not to pollute. We assume that bargaining is efficient and achieves an equal split of the joint surplus, as in the Nash bargaining solution. With probability $1 - \beta$ there is no bargaining because O and P cannot write enforceable contracts. For example, if P is only willing to pay for the right to pollute over time, O must bear the risk that P defaults and avoids paying damages, rendering contracts infeasible. Here β is a convenient parameter to study the comparative statics on the feasibility of bargaining, since contracts need to be enforced to support Coasian bargains.

In stage 2, the polluter decides whether or not to act.

In stage 3, if O 's property rights were violated because P polluted without O 's permission, then O can sue (or complain to the police, if that is the relevant law enforcer). The outcome depends on the legal rule. Under injunctive relief, P is enjoined from polluting, in which case he loses the benefit and suffers some additional cost. Then P is deterred by the threat of a fixed penalty $f > b$, which could be a monetary fine, imprisonment, or physical harm. The key assumption about f , whatever form it takes, is that it does not depend on any fact-intensive verification of harm, and as such cannot be subverted by a powerful polluter. Under a compensation regime, a P who is not powerful has to pay damages c equal to the assessed harm.⁴ A powerful P subverts the judgment so that assessed damages are equal to the minimum possible value, which for simplicity we assume to be zero. We thus assume that the court follows the law if P is not powerful, but is swayed through bribes or intimidation (or effective litigation) by a powerful P and assesses zero damages. Subversion in the assessment of damages means that the cost of pollution to a powerful P is independent of legal rules raising damages above the court estimate of harm, such as double and treble damages, unless they raise the minimum penalty for violation irrespective of harm—effectively establishing injunctive relief.

³ The powerful might also be able to subvert the finding of a violation with probability p_o . Our results remain qualitatively unchanged for all $p_o < 1$, because with probability ωp_o all legal rules are subverted and thus irrelevant. With probability $1 - \omega$ there is no subversion, but with probability $\omega(1 - p_o)$ only compensation is subverted. The same tradeoffs we highlight for $p_o = 0$ emerge more generally.

⁴ Damages that are higher in expectation than actual harm are undesirable: they distort the incentives of polluters who are not powerful, and make no difference for powerful polluters.

The key tradeoff already emerges. When $b > c$, P should pollute, but injunctive relief (without bargaining) deters all efficient pollution. We thus allow for the possibility that some property violations (pollution, trespass, takings) are efficient. In contrast, fair compensation, if perfectly enforced, achieves the first best when damages are equal to c —the basis for legal scholars' preference for liability rules. However, the compensation regime creates excessive pollution when there is an asymmetry of power between the two actors, since it allows powerful polluters to act with impunity. The tradeoff between insufficient pollution under injunctive relief and excessive pollution under subverted compensation is at the heart of our analysis.

Let $\Pi = E(b - c \mid b > c)\Pr(b > c)$ denote the expected social surplus from efficient pollution. Let $\Lambda = E(c - b \mid c > b)\Pr(c > b)$ denote the expected social loss from inefficient pollution. Note that $\Lambda > \Pi$ if and only if $b < E(c)$: intuitively, preventing inefficient pollution is a greater concern than allowing efficient pollution if and only if the expected social costs of pollution outweigh its social benefits (i.e., the social costs of pollution abatement).

Begin with the case in which P and O are unable to bargain. An effective injunction is enforced by a large fixed penalty $f > b$ such that no polluters pollute under injunctive relief and expected social surplus equals zero.⁵ Consider next the social payoffs under a compensation regime. If P is not powerful, fair compensation is mandated, so pollution occurs if and only if $b > c$. This is the first best and yields expected benefits of Π to P at no cost to O , who is fully compensated for her losses. However, the first best is attained only with probability $1 - \omega$. With complementary probability ω , P is powerful. Then the compensation regime is subverted, so pollution always takes place, resulting in an expected social welfare of $E(c) - b = \Pi - \Lambda$.

Bargaining enables the parties to write two Coasian contracts. First, P may agree in exchange for a payment from O to refrain from inefficient pollution. Second, O may agree in exchange for a payment from P to allow efficient pollution. When P pays O for the right to pollute in advance, no enforcement is needed. In contrast, when O pays P not to pollute, the contract needs to be enforced against P . This raises the question of what these contracts could be, and whether they are enforced against powerful polluters.

In the baseline case we study, we assume that contract enforcement takes the usual form of compensating O for the harm she suffers because of P 's breach. In this case, the natural

⁵ If instead $f < b$, then pollution always occurs and injunctive relief is effectively absent, just as if $f = 0$.

assumption we make is that if P is powerful the contract cannot be enforced against him, just like other payments of damages. If the contract is breached and O attempts to collect damages, P subverts justice and pays nothing.

An alternative assumption we can make is that contracts are enforced even against a powerful P . This could be the case if contracts specify liquidated damages, just like the penalty f for violating a property rule, and thus cannot be subverted. Similarly, contracts could require specific performance. Under these alternative assumptions, injunction and compensation become identical in the case of bargaining, and the only difference between the legal rules occurs in the case of no bargaining. In Appendix A1, we examine the model under alternative assumptions about contracting in detail. For the current discussion we simply note, as Proposition 1 will make clear, that there is still a case for injunction even if P must pay for contract violations.

Under injunctive relief, the only contract that can result from bargaining is one in which O allows P to pollute in exchange for a payment. There is no advantage in having P sign a contract that promises not to pollute since the law already prevents him from taking that action. But when O accepts a payment from P in exchange for her permission to pollute, the resulting contract is self-enforcing because we do not allow the owner to physically prevent pollution. The polluter who signed a contract permitting him to pollute actually does so, and the courts simply recognize that the owner has relinquished her ability to demand an injunction.

Coasian bargaining ensures that pollution occurs only when $b > c$. Injunctive relief, with bargaining, has become socially optimal. It accommodates efficient pollution and stops inefficient pollution, so it yields the first-best level of social welfare (Π) whenever bargaining is possible, which happens with probability β . Critically, the effectiveness of injunctive relief does not turn on the possibility of enforcing contracts against the polluter. Whether P is powerful or not, injunctions stop inefficient pollution. Contracts only allow efficient pollution, but since P pays up front for O 's permission, he has no way to breach the contract, so there are no lawsuits.

Under a compensation regime, all efficient pollution is accommodated, and bargaining is not needed to support it. As a consequence, the social benefit of efficient pollution (Π) is always reaped. However, the social loss of inefficient pollution (Λ) is also incurred when P is powerful because he cannot bargain and commit not to pollute in exchange for a payment from O . This of course changes if contracts are enforced against a powerful P ; see Appendix A1.

When contracts are not enforced against powerful polluters, under a compensation regime O is unwilling to bargain with a powerful P , and she has no need to bargain with a polluter who is not powerful. Bargaining becomes useless under a compensation regime, and inefficient pollution occurs with probability ω , whenever P is powerful.

Comparing the social payoffs under the two rules, integrating over both weak and powerful polluters, we obtain immediately a formal characterization of our key tradeoff (all proofs are presented in the appendix).

Proposition 1. The expected social surplus from compensation is greater than that from injunction if and only if $\omega < (1 - \beta)\Pi/\Lambda$.

Since an injunction stops all pollution, compensation is more attractive when the benefits from efficient pollution (Π) are higher, and when the costs imposed by inefficient pollution (Λ) are lower. Perhaps more interestingly, compensation is favored when the rule of law is stronger (ω is lower). In particular, for the case of perfect law enforcement studied by legal scholars ($\omega = 0$) compensation regimes (liability) are always preferred because they achieve the first best even without bargaining. More generally, there exists a unique threshold ω^* for the rule of law that determines whether compensation or injunction yield higher social benefits in the absence of bargaining. Compensation is preferred in more orderly societies.

Figure 5 sketches a view of history that would explain the gradual replacement of injunction with compensation, as was seen in the United Kingdom during the late 19th century. We graph time along the horizontal axis, and assume that the subversion of justice declines with development. We also assume that the benefits of pollution relative to costs first rise and then perhaps decline. The graph shows that initially injunction dominates compensation because subversion is high and the benefits of polluting activity are low. As the level of subversion falls with development, compensation eventually becomes more efficient than injunction.

In the developing world, the case for favoring injunction depends on the tradeoff between favoring development and avoiding externalities. A liability regime may enable a mining company to extract rents and subvert justice, but there may also be large economic benefits from its mining activity. Similarly, the use of eminent domain (which converts a property rule to a

liability rule) to convert centralized slums, like Kibera in Nairobi, to formal dwellings may achieve significant economic benefits, but the original residents may see few of those benefits.

The case for injunction is unambiguously stronger when bargaining is more feasible. With bargaining, injunctive relief is optimal even when the benefits from efficient pollution (Π) are much higher than the costs imposed by inefficient pollution (Λ). Injunctions give the owner the power to stop the polluter, but he will only use that power to bargain even with a strong polluter. Compensation does not facilitate bargaining between a weak O and a strong P so long as a strong P will break his contractual promise not to pollute with impunity. A strong P literally needs to be stopped unless and until he pays.

This final result vindicates Calabresi and Melamed's (1972) original intuition that property rules and bargaining are complements. The Coasian argument to the contrary requires perfect enforcement of contracts, just as the classic argument for liability rules requires their enforcement to be unbiased. When contract enforcement is vulnerable to subversion, owners whose entitlement is strongly protected by injunctive relief can sell it to efficient polluters. In contrast, owners whose entitlement is weakly protected by compensation cannot pay off powerful but inefficient polluters, because contracts are not reliably enforced against them.

In Appendix A1, we consider the alternative assumption that contracts can be enforced against a powerful P . Even in this case, so long as bargaining is sometimes infeasible, there is a strong presumption for injunctions: they are as good as compensation with perfectly enforced bargaining, and better without bargaining if subversion is prevalent ($\omega > \Pi/\Lambda$).

III.B. Powerful Owners

We have assumed so far that only powerful polluters can subvert the judicial assessment of damages. This asymmetry does not drive our results. On the contrary, compensation is even less attractive when there is an additional possibility that powerful owners can subvert the assessment of damages, by convincing the court that damages are extremely high. In the developing world, large local landowners often control the wheels of justice, so the case is relevant there as well.

As before, we assume that there is a probability ω that P is powerful and can subvert justice in his favor. We now also assume that O can subvert justice in her own favor with probability α . These two probabilities are disjoint because they reflect the probability of a power

mismatch: overall, the probability that justice is subverted is $\alpha + \omega \leq 1$. If the owner is powerful, then in a compensation regime the polluter will be subjected to arbitrarily high damages. In this way, powerful owners effectively transform a compensation regime into an injunction regime. As a result, a compensation regime is less likely to improve on an injunction regime. As before, whether either party is powerful is observed before bargaining or pollution take place.

Under injunctive relief, P never pollutes without bargaining because O just stops him. Either party's power to subvert the assessment of damages is irrelevant because courts are not tasked with assessing damages. With bargaining, injunctive relief assures that all efficient pollution takes place. In this case, P will just buy the right to pollute from O . The possibility that O is powerful is irrelevant because once she has sold her permission to pollute to P , she has no contractual obligation to perform and thus there is no need to enforce the contract against her.

Under a compensation regime, the first best is attained without bargaining when neither agent is capable of subversion. When P is powerful, compensation fails to prevent inefficient pollution, as before, because P cannot credibly sell a promise not to pollute. When O is powerful, compensation fails to enable efficient pollution. Bargaining suffices to solve the latter problem, as even a powerful O is able to sell the right to pollute. Bargaining does not solve the problem of over-pollution by the powerful, since the courts will assess zero damages for contract breach.

When the main threat of subversion comes from O rather than P , a third regime may become appealing. O can be denied any legal recourse, so that when bargaining is impossible she can neither enjoin efficient pollution nor deter it through her ability to subvert the assessment of damages. This regime permits all efficient pollution, but it also permits inefficient pollution unless the parties can bargain and P is not powerful, so the contract can be enforced against him.

Proposition 2 follows.

Proposition 2. If $\alpha < (1 - \omega)\Lambda/\Pi$ then compensation is optimal if and only if $\omega < (1 - \alpha)(1 - \beta)\Pi/\Lambda$ and injunction is optimal otherwise. If $\alpha > (1 - \omega)\Lambda/\Pi$ then no recourse is optimal if and only if $\omega < (\Pi/\Lambda - 1)(1 - \beta)/\beta$ and injunction is optimal otherwise.

Proposition 2 generalizes Proposition 1, which it includes as the special case $\alpha = 0$. The key new result is that two-sided subversion makes compensation even less attractive than one-sided subversion.

Consider first the case in which subversion is not too likely: $\alpha < (1 - \omega)\Lambda/\Pi$. This condition is necessarily satisfied if the expected costs of pollution exceed its benefits (i.e., $E(c) > b$ and thus $\Lambda > \Pi$). Then, just as in Proposition 1, compensation is optimal if subversion is rare, and injunction if subversion is common. In this more general setting, however, subversion by either party makes injunction more appealing. Formally, the threshold level of subversion that makes injunctive relief optimal is monotone decreasing in α .

Intuitively, the appeal of compensation is the possibility that courts deliver an unbiased assessment of damages. Both kinds of subversion reduce the probability of this happening. In our model two wrongs do not make a right. On the contrary, since powerful owners add to a compensation regime the downsides of injunction—namely, inefficient inaction when there is no bargaining—they further erode the benefits of compensation relative to injunction.

If the benefits of pollution exceed its expected costs and subversion is too prevalent ($\alpha > (1 - \omega)\Lambda/\Pi$), compensation becomes a dominated alternative that cannot be optimal regardless of which party is most likely to subvert. Intuitively, when subversion by both owners is common, optimality requires eschewing fact-intensive rules that respond to power rather than to efficiency. It is better to adopt a simple bright-line rule that assigns all decision-making power to one party in the absence of bargaining.

When bargaining is sufficiently common and both parties are likely capable of subverting justice, injunction remains optimal because powerful owners are capable of selling permission to weak polluters, whereas weak owners cannot trust powerful polluters' promise not to pollute in exchange for a payment. When bargaining is rare and O is much more likely to subvert than P , it becomes optimal to allow all pollution and deny the owner any legal recourse.

Figure 6 illustrates the impact of powerful owners on the optimal legal regime. It is drawn for the case $1 - \beta < \Lambda/\Pi < 1$, so there are three distinct regions in which each possible rule is optimal.⁶ When O can never subvert justice ($\alpha = 0$), we are in the case analyzed in Proposition 1: injunction is favored for high levels of subversion by the polluter (ω) and compensation is favored otherwise. As α rises, the threshold for favoring injunction falls up to the point where $\alpha = 1 - (1 - \Lambda/\Pi)/\beta$. As the likelihood of subversion by O rises further, the

⁶ If instead $\Lambda/\Pi > 1$ no recourse is never optimal; if $\Lambda/\Pi < 1 - \beta$ injunction is never optimal, as Proposition 1 already showed.

appeal of injunction is unchanged but that of compensation keeps declining: for intermediate likelihoods of polluter subversion (ω), it becomes optimal to grant O no recourse at all. For $\alpha > \Lambda/\Pi$, it is no longer ever optimal to use compensation. When the probability of facing a powerful owner is that high, the only options that remain appealing are no recourse and injunction.

III.C. Demand for Titling

A key challenge in economic development is the formalization of property (and activity) through titling (or registration). The evidence in this area is extremely puzzling. On the one hand, clarification and legalization of property rights appears to improve investment in land and property, especially in Latin America (e.g., Field 2005, 2007; Galiani and Schargrotsky 2010). On the other hand, there is also evidence that the poor are not willing to pay much for title, or to enter formality. Kerekes and Williamson (2010) present survey evidence that the poor are skeptical about the benefits of titling in Peru; Ali et al. (2014) document extremely low willingness to pay for tenure formalization in Tanzania. La Porta and Shleifer (2008) show that informal firms rarely become formal in developing countries. In our view, formal title is just a piece of paper, and securing property requires enforcement. We suggest that some of the challenges of formalization are better understood when such enforcement is not forthcoming.

We focus on the willingness to pay for land title, which we define as the reduction in nuisance- or trespass-related costs (or the increase in benefits from selling the right to pollute or trespass) associated with having legal title to a property. The title's only benefit is the ability to rely on the power of the law to defend one's property. We assume again that P is powerful with probability ω , and for simplicity that O is weak ($\alpha = 0$). The following result then holds.

Proposition 3. The willingness to pay for land title is always positive, and higher with injunction than with compensation. The difference in the willingness to pay for legal ownership generated by injunction relative to compensation increases with subversion (ω) and with the ability to bargain (β).

Injunctive relief always increases the willingness to pay for formal title, because without bargaining, injunction prevents the pollution of the property, whereas with bargaining, injunction enables the owner to extract a higher payment from a powerful polluter.

Compensation is particularly common in eminent domain cases, and it may be that abuse of those damage payments reduces the demand for land titling in the developing world. Singh (2012) documents extremely low levels of compensation given to Indian farmers by government officials, and even by the courts, when the government takes land for large industrial projects. Consistent with our prediction, Bezu and Holden (2014, p. 201) note that “a fear of land expropriation, which may be more pronounced on larger farms, may negatively influence the WTP [willingness to pay]” for a land registration certificate. The upshot of this evidence is that compensation is often a failed way to secure property rights, and property rules may work more effectively to increase demand for both title and formality.

IV. Investing in Power

In our leading example of natural resource extraction in developing countries, mining companies spend enormous resources to secure their activities, from hiring military protection to bribing judges and politicians. Shell allegedly spends millions of dollars on such measures in Nigeria. In development economics, the costs of oil revenues for institutional development and economic growth have come to be known as the “resource curse” (Prebisch 1950; Bannon and Collier 2003). But political power is not an endowment; it is a consequence of making investments.

Some evidence from the United States suggests how our comparison of injunctions and compensation might be relevant to thinking about problems of development. In the United States, disputes related to real property appear to reach courts much less frequently and to cost less than contract and tort disputes. Of about 750,000 civil cases that reached state courts in the 75 most populous US counties in 1992, about 49% were tort claims, 48% contract claims, and only 2% real property claims (Civil Justice Initiative *s.d.*). Moreover, real property cases cost, on average, about half to pursue of what, say, malpractice tort claims do. These observations raise the possibility that a further benefit of injunction, as compared to compensation, is to curtail disputes. The model we presented in Section 3 can be easily modified to address this conjecture.

In particular, we have assumed so far that power is exogenous. Of course, individuals can invest in power, both legally by hiring and retaining better lawyers, and extra-legally by investing in corruption and political connections. In the WJP expert surveys, there is a strong negative relationship between income per capita and the assessed need for private companies to

pay bribes or other inducements to “expedite” a court process. In the WJP general population surveys, respondents see courts among the least trusted institutions, and judges and magistrates among the most corrupt officials. Moreover, the less educated have the more skeptical assessments of judges and courts.⁷ The centrality of judicial corruption and bias suggests that, to assess legal rules and institutions, we need to examine not just the exercise of power by the strong, but also the incentives to acquire power. In this section, we examine this question not comprehensively, but rather by continuing our comparison of compensation and injunction. We show that injunction has the added benefit of curtailing investment in power.

We assume that, at stage 0, the polluter has the opportunity to invest i to become powerful. The decision to invest in power occurs before P knows whether he will be able to bargain with O . The cost of investment i is heterogeneous with cumulative distribution function $F(i)$. The rest of the model remains as in Section 3.

We first characterize the incentives to invest in power under different legal rules.

Proposition 4. With injunction, polluters never invest in power. With compensation, polluters invest in power whenever the cost of doing so is less than their private benefit from power $b - \Pi > 0$.

With injunction there is no investment in power because power yields no returns. Pollution simply does not occur when it is inefficient ($b < c$) or when bargaining is impossible. If pollution is efficient ($b > c$) and bargaining is possible, then P will pay some amount to O to permit pollution. Under injunctive relief, there is no reason why the terms of this contract should depend on the polluter’s power because contract enforcement is unnecessary.

Instead, compensation induces wasteful investment in power because the powerful can extract rents by subverting justice. In the absence of bargaining, a weak P is forced to internalize the social costs of pollution, so his private returns are equalized to the social returns (Π). A powerful P in contrast can ignore the social costs of his action while fully enjoying its private benefits $b > \Pi$. Proposition 5 describes the optimal regime when power is endogenous.

⁷ Across all countries in the WJP, 44 percent of respondents with an elementary school diploma or less said that judges decide cases according to the law, as opposed to what the government or powerful interests tell them to do. Instead, 51 percent of respondents with college degrees said that judges decide cases according to the law. The gap between the educated and uneducated declines when we control for country fixed effects, but remains statistically significant.

Proposition 5. When polluters can invest in power, the expected social surplus from compensation is greater than that from injunction if and only if the loss from inefficient pollution is below a threshold $\tilde{\Lambda} \geq 0$. The advantage of compensation declines with parties' opportunities to bargain ($\partial \tilde{\Lambda} / \partial \beta \leq 0$).

The main downside of compensation is precisely that its subversion enables inefficient pollution by the powerful. Compensation is optimal only when the loss from inefficient pollution is sufficiently low ($\Lambda < \tilde{\Lambda}$). When parties are more likely to bargain, injunction becomes more attractive and compensation less so. For any $\omega > 0$, injunction is optimal regardless of the social cost of pollution if bargaining is sufficiently likely ($\tilde{\Lambda} = 0$ for some $\beta < 1$).

Bargaining may eliminate social inefficiencies given the distribution of power; but when rights are insecure, bargaining does not eliminate the inefficiencies that come from trying to secure more bargaining power: on the contrary, it tends to exacerbate them. The flexibility of a liability regime encourages investment in influencing courts, and thus raises returns to power. This feature helps explain the enduring appeal of simple property rules.

V. Conflicting Claims

In the analysis so far, we have assumed that property rights are well defined, and considered the question of how best to secure them. Yet in many poor countries, property ownership is subject to informal arrangements, which raises the risk that too many potential victims of pollution or trespass demand injunctive relief, potentially threatening development. In this situation, we ask who should have the standing to obtain injunctive relief.

To fix ideas, we assume that P is damaging a plot of land farmed by a farmer we call O_1 . However, a second individual, the village chief called O_2 , can also plausibly claim to be suffering harm from P 's pollution. For example, the chief might in fact have residual claim to the land and be paying the farmer to work. In that setting, the damage to land would impact the chief but not the farmer. The chief could also be an absentee owner.

We denote by $p_i \geq 0$ the probability that O_i is the true harmed party, with $p_1 + p_2 = 1$. The key assumption here is that only one of the parties suffers from pollution, but not both. Critically for the analysis below, the two potential victims need not be equal in their ability to bargain. We let β denote the probability that the chief can sign an effective contract with the polluter that

transfers money immediately in exchange for the right to pollute. The farmer's probability of being able to contract is only $\beta\delta$ for $\delta < 1$, perhaps because he has even fewer resources to enforce the deal. We assume that the chief can always bargain when the farmer can.

When all three parties bargain, and either O_1 or O_2 can enjoin, then they will reach a Coasian bargain that ensures efficiency. When only the chief and the polluter bargain, they will reach the efficient solution as well as long as the chief is the harmed party. However, if the chief suffers no damage from pollution, he will allow P to proceed in exchange for a side payment or a bribe. The chief is "rotten" after all and does not internalize the costs to the farmer, unless the farmer is present at the bargaining table.

We finally assume that *a priori* the farmer has the higher probability of being the harmed party, so $p_1 > 1/2$. Thus the party more likely to be harmed is at a comparative disadvantage when it comes to bargaining. In many developing world contexts, this is a good assumption.

The court in principle has the capacity to determine both the extent of damages and the person who has suffered harm, but as before it can be subverted. If O_i suffers damage c and sues P , a powerful defendant can get the court to rule both that the harm is negligible and that the harm was not truly suffered by O_i . Consequently, the compensation system functions just as before. If P is weak, then the truly harmed party will be able to sue for damages and receive fair compensation. If P is strong, then subversion occurs and pollution proceeds with impunity.

Injunctive relief, however, can avoid subversion by relying solely on the probability that O_i suffered damages, which is common knowledge and cannot be subverted. The relevant question is who has standing to sue for injunctive relief. For example, in English law both owners and tenants have the right to sue in nuisance, but occupants without a legal title (such as lodgers and even the owner's or tenant's family members) do not (*Hunter v Canary Wharf Ltd* [1997] UKHL 14). The question of standing is even more critical in developing world contexts with ambiguous ownership. Under uncertain ownership, does everyone has the right to enjoin, or just the village chief, or only the farmer?

Our setting allows for three potential rules. Injunctive relief can be generally unavailable, which implies a compensation regime. Injunctive relief can be available to both O_1 or O_2 . Finally, one agent can be entitled to an injunction, while the other's only recourse is to sue for damages. When bargaining is impossible, we assume that if an agent O_i who is not harmed is

entitled to an injunction, she enjoins randomly with probability ε , irrespective of the true extent of harm c suffered by the other agent. This specification admits both $\varepsilon = 0$ and $\varepsilon = 1$, since we do not have strong priors about the behavior of the uninjured but empowered party.

The efficient rule admits the following characterization.

Proposition 6 (“Rotten Chief Theorem”). There are two thresholds Ω_0 and Ω_{12} , with $0 < \Omega_0 < 1 < \Omega_{12}$, such that pure compensation is optimal when $0 \leq \omega\Lambda\Pi < \Omega_0$, injunctive relief for the chief only is optimal when $\Omega_0 < \omega\Lambda\Pi < \Omega_{12}$ and injunctive relief for both the chief and the farmer is optimal when $\omega\Lambda\Pi \geq \Omega_{12}$. Pure compensation is less appealing when bargaining is more likely ($\partial\Omega_0/\partial\beta < 0$ and $\Omega_0/\partial\delta < 0$) and when an unharmed agent is less likely to enjoin ($\partial\Omega_0/\partial\varepsilon > 0$). Injunctive relief for both agents is less appealing when the chief is more and the farmer less likely to bargain ($\partial\Omega_{12}/\partial\beta > 0 > \partial\Omega_{12}/\partial\delta$), when an unharmed agent is less likely to enjoin ($\partial\Omega_{12}/\partial\varepsilon > 0$) and when the identity of the victim is more ambiguous ($\partial\Omega_{12}/\partial p_1 < 0$).

Since injunctive relief is meant to protect weak victims from powerful polluters, it might seem natural to grant it first and foremost to the most likely victim. However, this intuition is incomplete. Empowering the chief, even when he has no probability of being the harmed party, can improve efficiency, both because the chief is more likely to bargain and because the chief is less likely to enjoin when bargaining is impossible.

To build intuition, consider three extreme assumptions: $\omega = 1$, $p_1 = 1$ and $\varepsilon = 0$. In this case, empowering the chief is always better than a pure compensation regime, and empowering both agents is better than empowering the chief alone if and only if $\Lambda > \Pi$. The empowered chief dominates the pure compensation regime because the chief achieves the first best outcome when both he and the farmer bargain. If only the chief bargains, he always lets P pollute in exchange for a bribe, which is the outcome anyway with subverted compensation. When $\Lambda < \Pi$, it is better to pollute than not absent bargaining, and consequently it is better to empower the chief, who will not enjoin in the absence of bargaining since $p_1 = 1$ and $\varepsilon = 0$, than to empower than the farmer who will enjoin. When $\Lambda > \Pi$, it is better to empower both to stop pollution without

bargaining. If O_2 can bargain whenever O_1 can, there is no reason to grant exclusive injunctive relief to O_1 .⁸

More generally (even if $\omega < 1$, $p_1 < 1$ or $\varepsilon > 0$), injunctive relief for the victim alone is always worse than injunctive relief either for the chief alone or for both agents. Figure 7 shows this graphically by plotting the welfare levels associated with the four possible rules. The appeal of the “rotten chief” is that he is less likely to enjoin without bargaining and is always at the bargaining table whenever the farmer can bargain. When $\omega\Lambda < \Pi$, stopping all pollution is more socially costly than simply allowing the powerful to pollute. It is then better to give injunctive power to someone who will not always enjoin in the absence of bargaining, namely the chief, especially when polluting projects are likely to be on net socially beneficial.

When $\omega\Lambda$ is high relative to Π , it is better to grant injunctive relief to both potential victims. In these cases, it is socially optimal to shut down polluting projects in the absence of bargaining, and consequently both O_1 and O_2 should have the power to enjoin. Since there are states of the world in which the chief is the injured party and can bargain when the farmer cannot, empowering both is also more likely to lead to a better bargained outcome. If subversion is complete, this can be the case only when $\Lambda > \Pi$. If the farmer is known with certainty to be the victim ($p_1 = 1$), letting both the farmer and the chief enjoin is optimal if and only if $\Lambda > \Pi$.⁹

Bargaining makes the pure compensation regime less appealing, because it always yields the first best under injunctions but not under compensation. The asymmetry, as before, reflects the fact that a polluter cannot commit not to pollute. Lower values of ε also make compensation less appealing, because granting an injunction to someone who will not use it in the absence of bargaining is always better than compensation. Without bargaining, compensation and unused injunction are identical, while with bargaining injunctive relief yields better outcomes.

As the gap between the bargaining abilities of the chief and the farmer rises, it becomes more appealing to give the chief and not the farmer the power to enjoin. An increase in the probability that an unharmed party enjoins also makes universal injunction less appealing, because it increases the probability that socially beneficial polluting projects are stopped. Finally,

⁸ When $p_1 = 1$, it is identical to grant relief to O_1 only or to both agents. Universal injunctive relief is superior for any $p_1 < 1$ because O_2 could be the true victim and O_1 might fail to protect her with an injunction.

⁹ If the chief can be the true victim ($p_1 < 1$), granting injunction to the farmer too becomes optimal only when $\Lambda - \Pi$ is sufficiently large. The problem in this case is that an unharmed farmer may randomly demand an injunction when the chief and the polluter had reached an efficient bargaining agreement enabling pollution.

universal injunction becomes less appealing when the farmer is less likely to be the harmed party, since there is less benefit in granting him the power to stop projects in cases where the chief and the polluter have reached agreement.¹⁰

Our results suggest that empowering rotten chiefs may increase efficiency because these chiefs increase the chance of efficient bargaining and decrease the chance that socially beneficial projects are stopped. Of course, we have excluded any role for equity concerns in our analysis. If the chief is at the bargaining table, he will surely receive rents that might have gone exclusively to the farmer. If the social goal is to ensure that the harmed party receives as much compensation as possible, then it may again be optimal to empower the farmer and not the chief.

VI. Contract Enforcement

We have assumed throughout that if the polluter signs a contract promising not to pollute, then the remedy for breach of contract is the payment of damages, and that the powerful can subvert such payments just as they can subvert compensation in pollution or tort cases. Indeed, there are many examples in the developing world in which mining companies make contractual promises for making payments to affected locals, or for undertaking remedial actions, and then simply walk away from their promises without fear of enforcement. But just as injunctions can be less vulnerable to subversion than compensation in pollution cases, there is a parallel remedy in contract enforcement, namely specific performance. Indeed, as we show in this section, specific performance in contracts can be efficient for similar reasons to injunctions.

To establish the parallel between contracts and property, we keep our symbols unchanged and illustrate how the basic logic applies to contract enforcement. In stage 1, an owner (O) and a polluter (P) can sign a contract that generates baseline surplus u that can be split between them. If the parties do not sign a contract, the game ends with payoffs normalized to zero.

In stage 2, P can breach the contract, leading to an added payoff of b to himself and $-c$ to O . The value of c is observed before the breach but after the contract is signed, while b is known

¹⁰ The impact of ambiguity over the victim's identity on the appeal of pure compensation is ambiguous. When the chief is more likely to be the victim, granting him an injunction is more appealing because bargaining becomes more efficient, but less appealing because he is more likely to stop projects in the absence of bargaining. The former effect dominates if fully efficient bargaining is more likely and an unharmed chief is less likely to enjoin: $\partial\Omega_0/\partial p_2 > 0$ if and only if $\delta > \varepsilon$.

at the time of the contract. P knows his power relative to O at the time of the breach. We do not allow renegotiation at this stage (the equivalent of $\beta = 0$ after the fact).

In stage 3, O can sue P for breach of contract. So long as specific performance can be verified by courts or other authorities, P can be forced to remedy the breach, which costs him $f > b$, since he must forego any benefits of breach and pay the costs to remedy the previous action. With contractual damages, P has to pay the cost of the damages to O , namely c in the case of perfect enforcement.

If P is no more powerful than O , then contractual damages lead to efficient breach which raises the baseline surplus. With specific performance, there is no breach if there is no re-contracting in stage 2, so that the baseline surplus is the total surplus generated by the contract.¹¹ Consequently, if P is no more powerful than O , then contractual damages lead to the first best outcome and specific performance does not. This is the standard case stressed in law textbooks.

If P is more powerful than O , however, the flexibility of contractual damages leads to subversion, as the powerful persuade the court the damages are negligible. As noted by Cooter (2008, p. 1128) “the final advantage of specific performance concerns corruption,” because “damages allow judges to vary the award over a continuous range, which makes disguising bribes easier.” In this case, breach does not lead to large penalties imposed on the powerful.¹²

Contract is always breached in this case, and the surplus is reduced by $E(c) - b$. For the case of contracts, it is natural to assume that that $E(c) > b$ (hence $\Lambda > \Pi$). If an action yields positive expected surplus ($b > E(c)$), the contract would naturally be written ex ante so that the action constitutes correct performance rather than breach. Specific performance, in contrast, is not subverted. Consequently, breach does not occur and surplus is not eroded.

The logic of this reinterpretation is identical to that of the core model. Contractual damages dominate specific performance when the probability of judicial subversion is low. Specific performance, like injunction, dominates when power is asymmetric and the probability of judicial subversion is high.

¹¹ If there is re-contracting, then the situation is analogous to the pollution case with bargaining. The outcome that maximizes social surplus will occur with specific performance too, because the two parties agree to amend the contract to allow the breach for a specified side payment.

¹² Dunworth and Rogers (1996) find that larger corporations typically outperform all other parties in contract disputes, including smaller businesses. Galanter (2001) similarly finds that corporations overwhelmingly defeat individuals in contract litigation.

These issues have played out in legal history. In the famous case of *Peevyhouse v. Garland Coal & Mining Co.* (382 P.2d 109, Okla. 1962), the Oklahoma Supreme Court ruled that the coal miner did not have to honor its contractual promise to perform remedial work in order to restore the small farmers' property after strip mining. Instead, it merely owed damages for nonperformance. The trial jury, taking into account both the diminished value of the property and the cost of remediation, had awarded damages of \$5,000. On appeal, the Supreme Court reduced damages to \$300, ruling the cost of remediation immaterial. Many legal scholars celebrate this outcome as the triumph of economic efficiency over bleeding-heart sentimentalism, since the coal company paid damages rather than the high cost of restoring the land. Like us, however, some are concerned with the inequity of the outcome (Kennedy and Michelman 1980; Maute 1995).

In our case, the matter is not just inequity of the outcomes, but also inefficiency. In our basic model, enforceable Coasian contracts against the strong – if specific performance indeed makes them enforceable – improve efficiency because they improve bargaining opportunities between a weak owner and a strong polluter. But also, since if the weak foresee legal abuse, they will not avoid all contracts with the strong, so specific performance can improve matching. In this respect, we establish the following result.

Proposition 7. A contract enforced by specific performance is always signed. A contract enforced by compensatory damages is signed if and only if the expected power of the contracting parties is sufficiently symmetric that $\omega < (u + \Pi)/\Lambda$.

In equilibrium, when the remedy for breach is damages rather than specific performance, many contracts will simply be avoided. The strong will contract with the strong, the weak with the weak, and gains from trade between parties of different legal strengths will not be realized. Trust necessary for parties to make Coasian bargains disappears when justice is subverted.

The absence of asymmetric contracts may explain why damages have come to be preferred in many of the common law legal debates on contract enforcement while injunctive relief is still preferred to secure rights of possession.¹³ But while asymmetric contracts can be avoided in equilibrium (presumably with a loss of gains from trade), the same does not apply to

¹³ Schwartz (1979) is a prominent counter-example, advocating specific performance because of fears of under-compensation with damages.

pollution, trespass or taking. A poor farmer can decide not to enter a contract with a powerful corporation, but that corporation can still damage his crops or even expropriate his land. When damage awards are subverted by the strong, specific performance may be the more efficient way to deal with breach, just as injunction is the more efficient way of securing property. The less corrupt the judiciary, the easier the transition to compensatory damages.

VII. Summary and Implications

In conclusion, we summarize some of our principal findings, but also draw out some of the new empirical predictions of our approach. We have argued that many legal institutions central to growth and development evolve in recognition of asymmetries of power between the weak and the strong. We began by showing empirically that looking across countries as well as across people of different social status within countries, belief that the justice system is biased against the poor and the weak is common among both experts and the public. We then argued that this legal insecurity of the poor is fundamental to understanding both legal rules and popular engagement with the legal system.

We focused on the specific problem of pollution of a farm by a mine emitting waste and ruining crops, although we argued that the analysis applies to trespass or takings as well. We asked what remedies are appropriate in this case: injunctions or other property rules that stop production until the mine cleans up its act, or compensation or other liability rules that pay the farmer damages after the fact. We showed that a key reason for property rules is that liability rules are vulnerable to subversion by the strong, and as such do not secure property. Our approach yields two central predictions. First, in general, liability rules should become more common as the quality of judicial institutions improves. Second, property rules lead to less harm to the property of the weak and thus to more progressive outcomes than do liability rules.

We then argued that the flip side of subversion of justice is investment in power, through investment in litigation, corruption, or even force. We showed that injunctions reduce incentives for such investment. Again, our approach makes strong empirical predictions. It suggests that investments in rent-seeking and corruption should be higher in judicially weaker regimes, a result at least superficially consistent with higher prevalence of judicial corruption in developing countries. Perhaps more subtly, our model suggests that looking across areas of law, liability

rules or other damage-based approaches to dispute resolution entail higher legal costs than property rules or other bright line regimes.

Since our principal focus is on weak law enforcement, we have applied our analysis to several problems of economic development. We linked the observed lack of demand for formality and titling in developing countries to subversion of justice and thus low benefits of formality. Our approach predicts that demand for formality is higher in places where justice is more fairly administered, and that, when it is not, the strong will have a greater demand for formality or title than the weak. We also applied our framework to the highly empirically relevant situation in which property rights are not well defined, let alone protected, and asked whether injunctions in this case can do more harm than good. We found that there is still a good case for injunctions. Our analysis predicts that it is often efficient to give standing in seeking injunctions to parties who are more effective bargainers, such as village chiefs, even when they do not have a clear personal economic interest in the matter.

The subversion of justice strengthens the case for the use of injunctive relief to secure property and the use of specific performance to secure contracts. Like injunctive relief, specific performance eliminates the fact-intensive task of determining damages. That task seems just as liable to subversion in contract disputes as in conflicts over damage to property. Consequently, specific performance may enable the contracting space to expand in places with weak judicial systems. Our model predicts that contracts between parties with asymmetric power are more likely to appear as justice gets more fair, and that specific performance, with all its recognized inefficiencies, may still be more prevalent in jurisdictions where justice can be easily subverted.

The lens of subversion of justice helps resolve several puzzles in both law and economics and development economics, but also yields many new predictions.

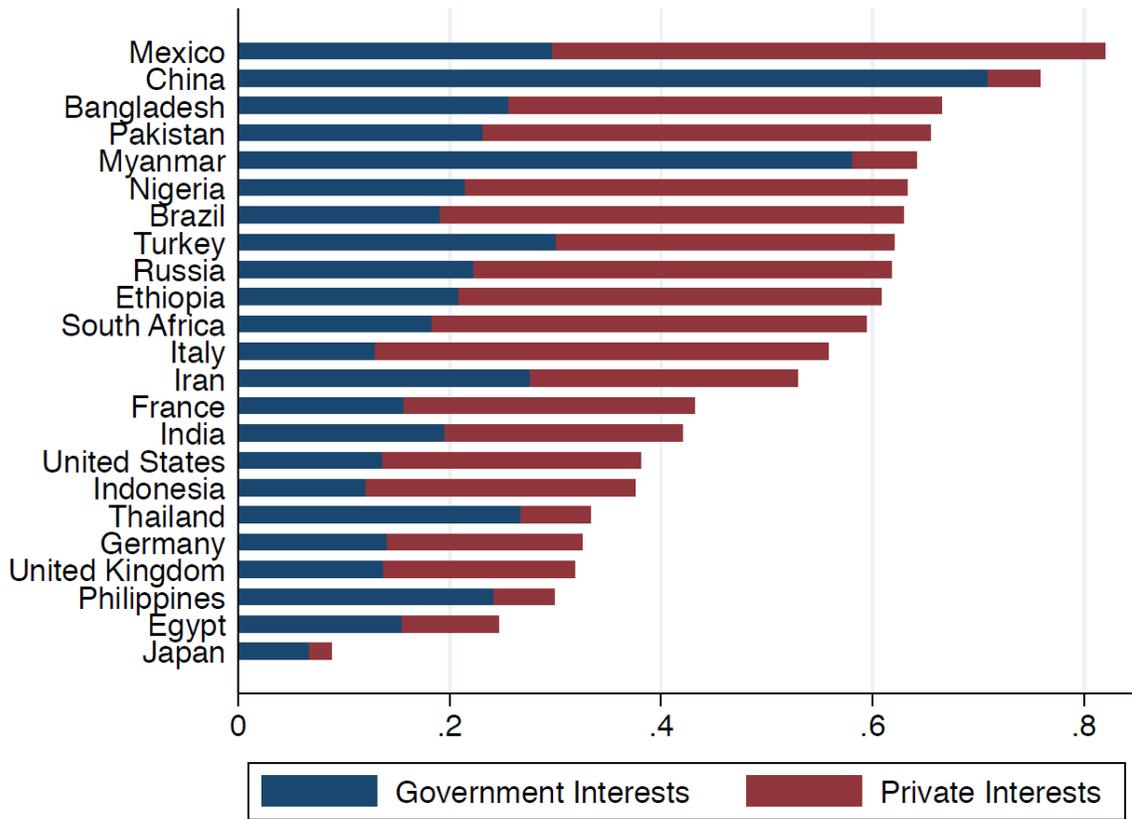
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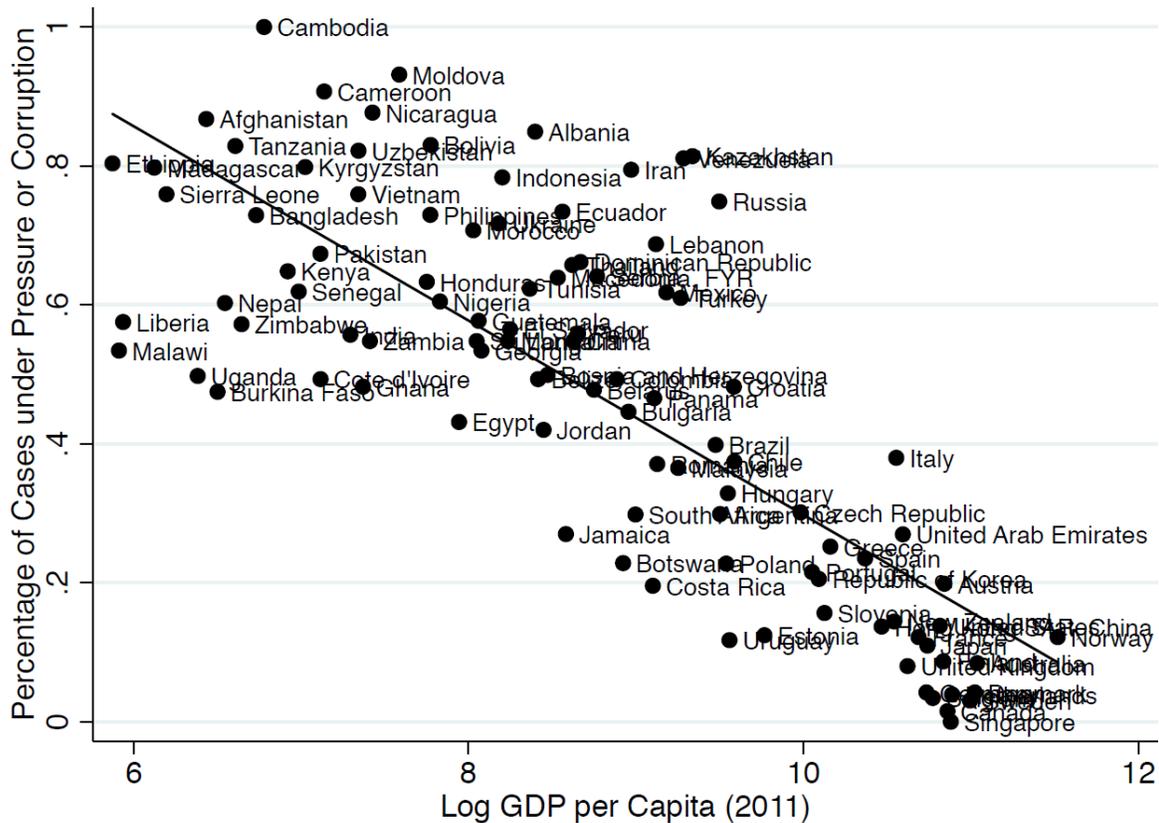
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Figure 1. Popular Perception of Undue Influence over Judges



Notes: Survey responses from the World Justice Project, General Population Poll, most recent survey 2012-2014 for countries with population over 50 million in 2011. The graph depicts the share of respondents who give the following answers. “(q8) In your opinion, most judges decide cases according to (provide single answer): (1) What the government tells them to do [shown in blue]. (2) what powerful private interests tell them to do [shown in red]. (3) What the law says [remainder].”

Figure 2. Experts' Assessment of Undue Influence over Judges



Notes: GDP per capita in current U.S. dollars from the World Development Indicators, 2011. World Justice Project, Rule of Law Index variable QRQ86 (rescaled): average response to the following survey question in the 2014 Qualified Respondent Questionnaires on Civil and Commercial Law (CC q18b) and Labor Law (LB q11b). “Based on your experience during the past year with [CC: civil cases between private parties decided by / LB: labor dispute cases (cases between private parties) decided by labor or civil] trial courts, what percentage (%) of cases reflect the following outcomes: The final decision was influenced by undue pressure from one of the parties or was influenced by corruption.”

Figure 5. The Evolution of Optimal Rules

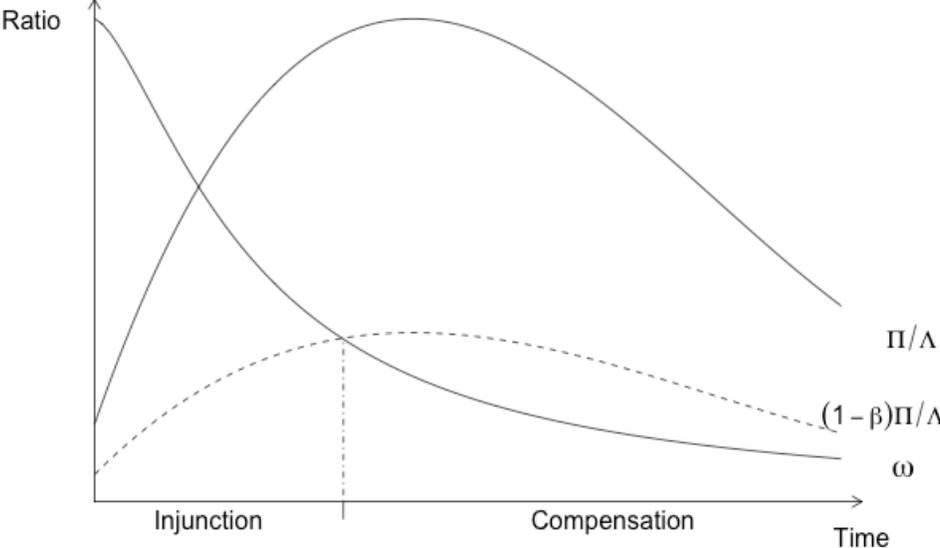
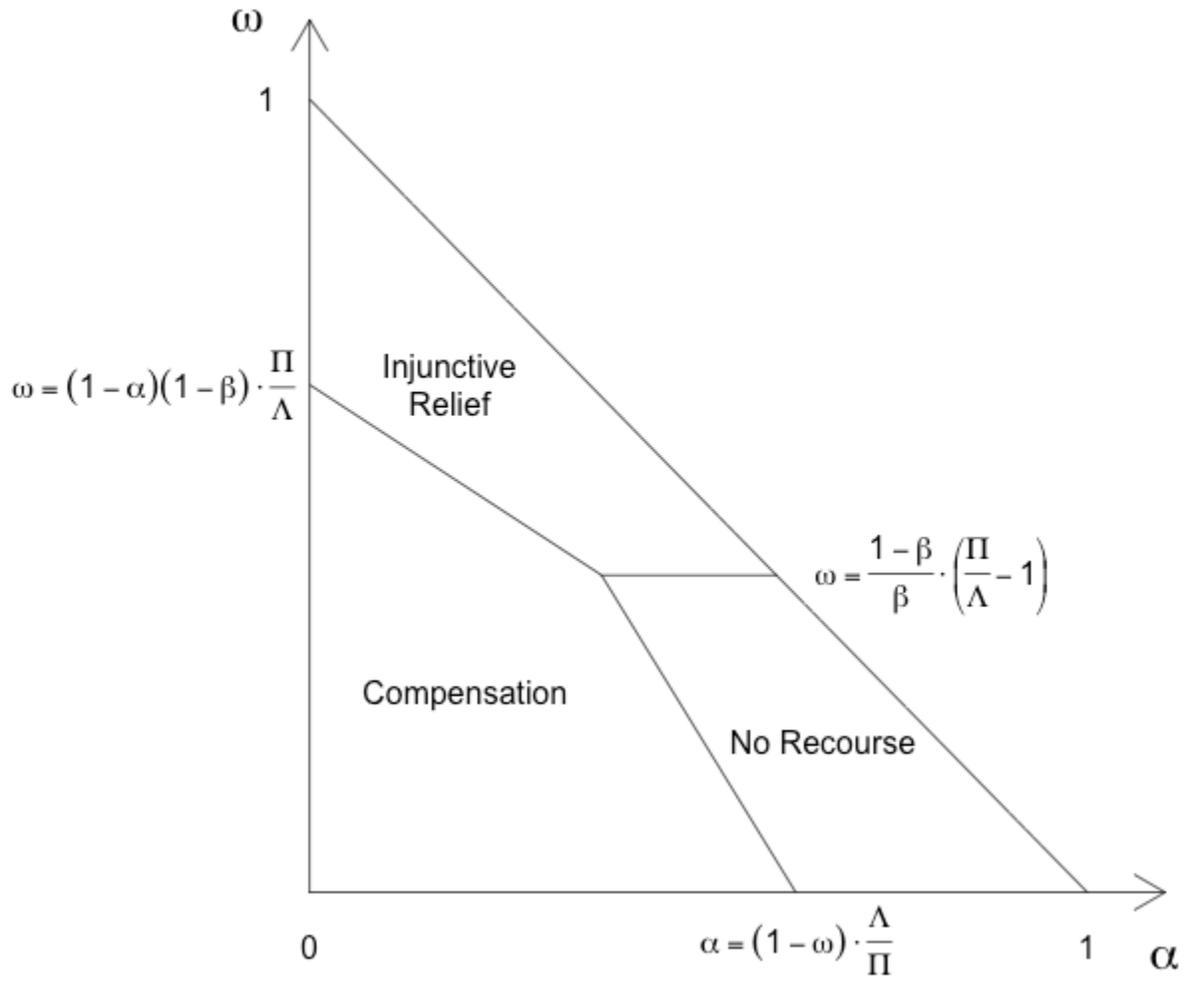
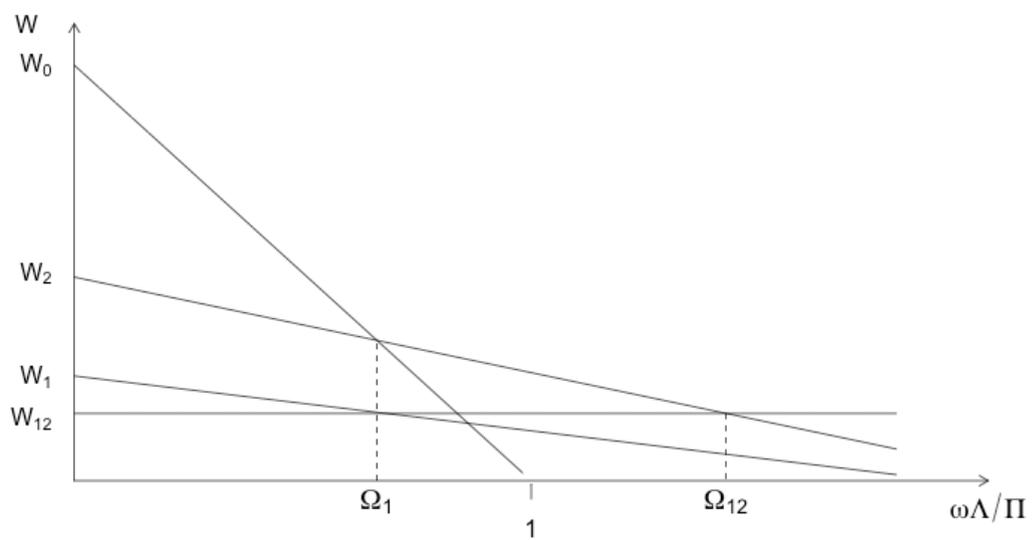


Figure 6. Optimal Rules with Two-Sided Subversion



Optimal Rules for $1 - \beta < \Lambda/\Pi < 1$

Figure 7. Welfare with Conflicting Claims



Notes: W_0 plots welfare from pure compensation, W_1 welfare from injunctive relief for the villager only, W_2 welfare from injunctive relief for the chief only and W_{12} welfare from injunctive relief for both agents.

Table 1: Perceptions of Lawfulness

	Government compensates homeowners fairly for taking	Homeowners sue government for unfair compensation	Court awards homeowners fair compensation	Judges stop illegal government decision	Polluting company complies with the law
	(1)	(2)	(3)	(4)	(5)
<i>Linear Probability Model</i>					
Post-Graduate Degree	0.065 ^{***} (0.014)	0.027 ^{**} (0.012)	0.042 ^{**} (0.016)	0.059 ^{***} (0.013)	0.041 ^{***} (0.012)
College Degree	0.028 ^{**} (0.011)	0.025 ^{***} (0.009)	0.014 (0.012)	0.054 ^{***} (0.011)	0.034 ^{***} (0.011)
High School or Middle School Diploma	0.012 (0.009)	-0.010 (0.006)	-0.003 (0.009)	0.028 ^{***} (0.008)	0.029 ^{***} (0.011)
Homeowner	0.015 ^{**} (0.006)	0.012 ^{**} (0.005)	0.020 ^{***} (0.006)	0.027 ^{***} (0.006)	0.021 ^{***} (0.003)
Adjusted R-Squared	0.103	0.145	0.094	0.123	0.119
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	94,582	95,080	93,461	93,781	92,378

Notes: Survey responses from the World Justice Project, General Population Poll, most recent survey 2012-2014. Regressions report as a function of self-reported educational attainment (omitted category: primary school diploma or less) and homeownership the probability that respondents answer “Very likely” or “Likely” to the questions, for the first four columns, and the probability that respondents answer “the company complies with the law,” for the last column. For the first three columns: “Please assume that the government decides to build a major public works project in your neighborhood (such as a railway station or a highway), and assume the construction of this public works project requires the demolition of private homes in your community/neighborhood. (q1a) How likely are these homeowners to be fairly compensated by the government? Now, assume that the monetary compensation offered by the government for the demolition of the houses is clearly unfair and inadequate. How likely are the following outcomes? (q1b.1) Homeowners would sue the government in court. [...] (q1c) Finally, if the homeowners sue the government, how likely is it that they obtain fair compensation in court?” For the fourth column: “Assume that a government officer makes a decision that is clearly illegal and unfair, and people complain against this decision before the judges. (q10a) In practice, how likely is that the judges are able to stop the illegal decision?” For the last column: “(q3) Assume that the Environmental protection authority [...] notifies an industrial plant that it is polluting a river beyond the legally permitted levels. Which of the following outcomes is most likely? a) the company complies with the law, b) the company bribes or influences the authority [...], or c) absolutely nothing happens.” Robust standard errors clustered by country in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Resolution of Contract Disputes

	Had contract dispute during past 3 years	Resorted to courts for dispute resolution	Court process was objective and unbiased	Courts guarantee everyone a fair trial
	(1)	(2)	(3)	(4)
	<i>Linear Probability Model</i>			
Post-Graduate Degree	0.054*** (0.008)	0.032 (0.025)	0.084* (0.049)	0.051*** (0.013)
College Degree	0.034*** (0.007)	0.058*** (0.018)	0.056 (0.044)	0.031*** (0.011)
High School or Middle School Diploma	0.013*** (0.004)	0.011 (0.016)	0.060 (0.043)	0.005 (0.009)
Homeowner	- 0.002 (0.005)	0.022* (0.013)	- 0.002 (0.021)	0.017** (0.007)
Adjusted R-Squared	0.072	0.106	0.102	0.158
Country Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	96,125	10,857	3,362	93,082

Notes: Survey responses from the World Justice Project, General Population Poll, most recent survey 2012-2014. Regressions report as a function of self-reported educational attainment and homeownership the probability of the following answers. In Column 1: "(q35) During the past three years, have you or someone in your household had a conflict with someone who refused to fulfill a contract or pay a debt? Yes." Conditionally, in Column 2: "(q35a) Which one of the following mechanisms was used to solve the conflict? Filed a lawsuit in court / Used a small-claims court or procedure." Conditionally, in Column 3: "(q35b) In your opinion, was the process objective and unbiased? Yes." In Column 4: "Please tell me how often would you say that (q37c) the courts in [country] guarantee everyone a fair trial? Always / Often." Robust standard errors clustered by country in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

APPENDICES

A1. Contracts Enforced Against the Powerful

In our baseline model we assumed that if P is powerful a contractual promise not to pollute cannot be enforced against him. If the contract is breached, and O attempts to collect for the breach, P subverts justice and pays no damages. In this appendix, we consider the alternative case in which such contracts can be enforced against a powerful P . This might be the case, in particular, if breach of contract is remedied by specific performance rather than by compensatory damages, as we discussed in Section 6.

A1.1. *The Basic Model*

When contracts can be enforced against the powerful, Coasian bargaining occurs with probability β , even under a pure compensation regime. Then O can bargain with a powerful T and pay for his promise not to pollute, and he can credibly commit to keep the promise. As a result, with probability β we are back to the Coasian world in which efficient outcomes are achieved regardless of initial entitlement and of the rules protecting them. The case for injunctive relief is weakened but not eliminated.

Proposition A.1. If contracts can be enforced against the powerful, the expected social surplus from compensation is greater than that from injunction if and only if $\omega < \Pi/\Lambda$.

Just as in Proposition 1, compensation is favored if and only if the rule of law is strong enough (ω is low), and it remains more appealing when the benefits from efficient pollution (Π) are higher and the costs of inefficient pollution (Λ) lower. However, it is unambiguously less appealing than when contracts cannot be enforced against the powerful.

When contracts can be enforced against a powerful P , injunction can be optimal only if the expected costs of pollution are greater than its benefits ($E(c) > b$ so $\Lambda > \Pi$), and its optimality is independent of the probability of bargaining β . This result reflects the Coasian insight of Kaplow and Shavell (1996). When bargaining is efficient and contracts are perfectly enforced, the optimal legal rule concerns only those cases in which bargaining is impossible. Then, if and

only if pollution is socially wasteful on average, it can be better to let O enjoin all pollution—including efficient pollution—rather than enabling unrestrained pollution by the powerful.

A1.2. Powerful Owners

When contracts can be enforced against a powerful P , Coasian bargaining achieves the first best with probability β even when the owner has no recourse against pollution in the absence of bargaining. Nonetheless, compensation remains optimal only if subversion is sufficiently rare.

Proposition A.2. Suppose contracts can be enforced against the powerful. If $\Lambda > \Pi$ expected social surplus is maximized by compensation if $\omega < (1 - \alpha)\Pi/\Lambda$ and by injunction otherwise. If $\Pi > \Lambda$ expected social surplus is maximized by compensation if $\alpha < (1 - \omega)\Lambda/\Pi$ and by no recourse otherwise.

Just as in Proposition A.1, optimal rules are independent of the probability of bargaining (β) if contracts can be enforced against powerful polluters. Hence, injunctive relief can be appealing only if $E(c) > b$ and thus $\Lambda > \Pi$. In that case, as in our baseline model, two-sided subversion makes injunction even more attractive than one-sided subversion: the threshold level of subversion that makes injunctive relief optimal is monotone decreasing in α .

A1.3. Demand for Titling

The willingness to pay for title is higher with injunction than with compensation irrespective of the ability to enforce contracts against the powerful.

Proposition A3. Suppose contracts can be enforced against the powerful. The willingness to pay for land title is always positive, and higher with injunction than with compensation. The difference in the willingness to pay for legal ownership generated by injunction relative to compensation increases with subversion (ω). It increases with the ability to bargain (β) if and only if $\omega < \Pi/\Lambda$.

The only difference between this result and Proposition 3 is that a greater likelihood of bargaining no longer unambiguously raises the benefits of injunctive relief. Coasian bargaining with perfect enforcement solves all inefficiencies, so it is of greater help in the more inefficient scenario—which is mere compensation if subversion is prevalent enough.

A1.4. Investing in Power

While the ability to enforce contracts against the powerful makes compensation more efficient conditional on power, it heightens incentives for investment in power.

Proposition A4. Suppose contracts can be enforced against the powerful. With injunction, polluters never invest in power. With compensation, polluters invest in power whenever the cost of doing so is below a threshold $\bar{t} > 0$, which is increasing in the likelihood of bargaining ($\partial \bar{t} / \partial \beta > 0$) and always higher than it would be if contracts could not be enforced against the powerful.

Trespassers are more likely to invest in power under a liability rule when bargaining is more likely and contracts can be enforced against all because power enables extortion and extortion requires bargaining with commitment. The complementarity between bargaining and injunctive relief then re-emerges even when Coasian bargaining is fully efficient ex post. Proposition 5 is unchanged if contracts can be enforced against the powerful.

Proposition A5. Whether contracts can be enforced against the powerful or not, if polluters can invest in power the expected social surplus from compensation is greater than that from injunction if and only if the loss from inefficient pollution is below a threshold $\tilde{\lambda} \geq 0$. The advantage of compensation declines with parties' opportunities to bargain ($\partial \tilde{\lambda} / \partial \beta \leq 0$).

A1.5. Conflicting Claims

When contracts can be enforced against the powerful, the role of the chief as a bargaining broker disappears. If the farmer can join the bargaining table, he can get P to commit not to pollute without the chief's help. If the farmer cannot join the bargaining table, the rotten chief fails to internalize her costs. Nevertheless, it remains optimal to give injunctive relief to the chief and not to the farmer when subversion is intermediate.

Proposition A6. Suppose contracts can be enforced against the powerful. There is a threshold $\Omega_{12} > 1$ such that pure compensation is optimal when $0 \leq \omega \Lambda / \Pi < 1$, injunctive relief for the chief only is optimal when $1 < \omega \Lambda / \Pi < \Omega_{12}$ and injunctive relief for both the chief and the farmer is optimal when $\omega \Lambda / \Pi \geq \Omega_{12}$. Injunctive relief for both agents is less

appealing when the chief is more and the farmer less likely to bargain ($\partial\Omega_{12}/\partial\beta > 0 > \partial\Omega_{12}/\partial\delta$), when an unharmed agent is less likely to enjoin ($\partial\Omega_{12}/\partial\varepsilon > 0$) and when the identity of the victim is more ambiguous ($\partial\Omega_{12}/\partial p_1 < 0$).

Just as in Proposition A1, once contracts are perfectly enforced against the powerful injunctive relief is optimal if and only if the risk of inefficient pollution by the powerful is a greater social concern than the lack of efficient pollution when bargaining is impossible ($\omega > \Pi/\Lambda$). Thus, in particular, pure compensation is optimal whenever the social benefits of efficient pollution exceed the expected social costs of inefficient pollution ($\Pi > \Lambda$).

Just as in Proposition 6, however, when subversion is limited O_2 should not have standing to enjoin. Granting her injunctive relief has the benefit of protecting her from inefficient pollution when she cannot bargain, a socially desirable protection that the rotten chief fails to provide. However, injunctive relief for the farmer also a cost (for $p_1 < 1$, $\delta < 1$ and $\varepsilon > 0$): an unharmed farmer is liable to enjoin efficient pollution that the truly harmed chief would otherwise optimally sell P permission for. The social benefit of farmer injunctions is greater than their social cost only when subversion is prevalent enough. Intuitively, this is harder when the villager is less likely to be harmed, less likely to bargain, and more likely to enjoin for no reason, and when the chief is more likely to bargain instead.

A2. Proofs

Proof of Proposition 1

The expected social surplus from injunction equals $\beta\Pi$. The expected social surplus from compensation equals $(1 - \omega)\Pi + \omega(\Pi - \Lambda) = \Pi - \omega\Lambda$. The result follows.

Proof of Proposition 2

The expected social surplus from injunction equals $\beta\Pi$. The expected social surplus from compensation equals $[1 - \alpha(1 - \beta)]\Pi - \omega\Lambda$. The expected social surplus if the owner has no recourse equals $\Pi - [1 - \beta(1 - \omega)]\Lambda$.

No recourse yields higher expected social surplus than compensation if and only if $\alpha > (1 - \omega)\Lambda/\Pi$. Then injunction yields higher expected social surplus than no recourse if and only if ω

$> (\Pi/\Lambda - 1)(1 - \beta)/\beta$. If $\alpha < (1 - \omega)\Lambda/\Pi$ then injunction yields higher expected social surplus than compensation if and only if $\omega > (1 - \alpha)(1 - \beta)\Pi/\Lambda$.

Proof of Proposition 3

Without title, O suffers the cost of pollution whenever bargaining is impossible. When bargaining is possible, she can pay a weak P to refrain from inefficient pollution. Therefore, her expected payoff equals $-E(c) + \frac{1}{2}\beta(1 - \omega)\Lambda$.

With compensation, title enables O to avoid harm or obtain compensation from a weak P ; a powerful P merely pollutes. Therefore, O 's expected payoff equals $-\omega E(c)$. Hence her willingness to pay for title under a compensation regime is $V_L = (1 - \omega)[E(c) - \frac{1}{2}\beta\Lambda] > 0$.

With injunction, title enables O to stop pollution when she cannot bargain, and to allow it for a price when she can. Therefore, her expected payoff equals $\frac{1}{2}\beta\Pi$. Hence her willingness to pay for title under injunctive relief is $V_P = \frac{1}{2}\beta\Pi + E(c) - \frac{1}{2}\beta(1 - \omega)\Lambda > 0$.

The difference in the willingness to pay for legal ownership generated by injunction relative to compensation equals $V_P - V_L = \frac{1}{2}\beta\Pi + \omega E(c) > 0$, which is increasing in β and ω .

Proof of Proposition 4

With injunction, P is deterred from trespassing unless he can bargain with O and buy her permission. Hence, his expected payoff is $\frac{1}{2}\beta\Pi$ irrespective of his power. Since power does not increase P 's payoff, he never invests in acquiring it.

With compensation, if P is weak he is induced to act optimally and his expected payoff equals the social value of efficient action Π . If P is strong he pollutes irrespective of the cost to O and his payoff is b . Therefore, he invests in power if and only if $i < b - \Pi$.

Proof of Proposition 5

When polluters can invest in power, the expected social surplus from compensation equals $\Pi - F(\bar{i})[\Lambda + E(i | i < \bar{i})]$. The expected social surplus from injunction equals $\beta\Pi$.

The difference in the expected social surplus from compensation and injunction is $\Delta = (1 - \beta)\Pi - F(\bar{i})[\Lambda + E(i | i < \bar{i})]$. Hence, compensation is socially optimal if and only if $\Lambda < \tilde{\Lambda} = \max\{0, (1 - \beta)\Pi/F(\bar{i}) - E(i | i < \bar{i})\}$, such that $\partial\tilde{\Lambda}/\partial\beta = -\Pi/F(\bar{i}) < 0$ if $\tilde{\Lambda} > 0$.

Proof of Proposition 6

A pure compensation regime accommodates all efficient pollution, but it also enables all inefficient pollution by a powerful P when contracts cannot be enforced against him. Thus, expected social surplus is $W_0 = \Pi - \omega\Lambda$.

If O_1 alone is entitled to an injunction, she reaches the first best when everyone can bargain, but when she cannot bargain and is not the true victim she forbids all pollution with probability ε and allows all pollution with probability $(1 - \varepsilon)$. Thus, expected social surplus is $W_1 = \beta\delta\Pi + (1 - \beta\delta)(1 - p_1)(1 - \varepsilon)(\Pi - \omega\Lambda)$.

If O_2 alone is entitled to an injunction, her behavior is equally random when she cannot bargain and she is not the true victim. When she can bargain, she always allows efficient pollution, but she also allows inefficient pollution when she doesn't suffer harm and the victim cannot bargain. Thus, expected social surplus is $W_2 = (1 - \beta)p_1(1 - \varepsilon)(\Pi - \omega\Lambda) + \beta\Pi - \beta(1 - \delta)p_1\omega\Lambda$.

If both O_1 and O_2 are entitled to an injunction, they prevent all inefficient action, but they also prevent efficient action if the true victim cannot bargain, and with probability ε even if she can but the other agent cannot. Thus, expected social surplus is $W_{12} = \beta[\delta + (1 - \delta)(1 - \varepsilon)(1 - p_1)]\Pi$.

To simplify notation, normalize $\Pi = 1$ and define $\Omega = \omega\Lambda/\Pi \geq 0$. Then the four expected social surpluses W_0 , W_1 , W_2 and W_{12} are affine functions of Ω with $\partial W_0/\partial\omega < \partial W_2/\partial\omega < \partial W_1/\partial\omega < \partial W_{12}/\partial\omega = 0$.

$W_0(\Omega) > W_2(\Omega)$ if and only if $\Omega < \Omega_0 = [1 - (1 - \varepsilon)p_1]/\{[1 - p_1(1 - \beta\delta)]/(1 - \beta) + \varepsilon p_1\}$, such that $\partial\Omega_0/\partial\beta < 0$, $\partial\Omega_0/\partial\delta < 0$ and $\partial\Omega_0/\partial\varepsilon > 0$, while $\partial\Omega_0/\partial p_1 < 0$ if and only if $\delta > \varepsilon$.

$W_{12}(\Omega) > W_2(\Omega)$ if and only if $\Omega > \Omega_{12} = [\varepsilon\beta(1 - \delta)/p_1 + (1 - \varepsilon)(1 - \beta\delta)]/[\varepsilon\beta(1 - \delta) + (1 - \varepsilon)(1 - \beta\delta)]$, such that $\partial\Omega_{12}/\partial\beta > 0$, $\partial\Omega_{12}/\partial\delta < 0$, $\partial\Omega_{12}/\partial\varepsilon > 0$ and $\partial\Omega_{12}/\partial p_1 < 0$.

$W_{12}(\Omega) > W_1(\Omega)$ if and only if $\Omega > (1 - \beta)/(1 - \beta\delta)$. Thus, $W_1(\Omega) < \max\{W_2(\Omega), W_{12}(\Omega)\}$ for all $\Omega \geq 0$ because $\Omega_{12} > 1 > (1 - \beta)/(1 - \beta\delta)$.

Proof of Proposition 7

A contract enforced by specific performance is never breached, so it yields surplus $u > 0$ with certainty. A contract enforced by compensatory damages is breached whenever breach is efficient or T is powerful. Thus, it yields expected surplus $u + \Pi - \omega \Lambda$, which is positive if and only if $\omega < (u + \Pi)/\Lambda$.

Proof of Proposition A1

The expected social surplus from injunction equals $\beta\Pi$. The expected social surplus from compensation surplus $\Pi - \omega(1 - \beta)\Lambda$. The result follows.

Proof of Proposition A2

The expected social surplus from injunction equals $\beta\Pi$. The expected social surplus from compensation equals $[1 - \alpha(1 - \beta)]\Pi - \omega(1 - \beta)\Lambda$. The expected social surplus if the owner has no recourse surplus $\Pi - (1 - \beta)\Lambda$.

No recourse yields higher expected social surplus than injunction if and only if $\Lambda < \Pi$. It also yields higher expected social surplus than compensation if and only if $\alpha > \Lambda/\Pi$. Injunction yields higher expected social surplus than no recourse if and only if $\Lambda > \Pi$. It also yields higher expected social surplus than compensation if and only if $\omega > (1 - \alpha)\Pi/\Lambda$.

Proof of Proposition A3

Without title, O suffers the cost of pollution whenever bargaining is impossible. When bargaining is possible, she can pay P to refrain from inefficient pollution. Therefore, her expected payoff equals $-E(c) + \frac{1}{2}\beta\Lambda$.

With compensation, title enables O to avoid harm or obtain compensation from a weak P ; a powerful P pollutes if he cannot bargain, or demands a payment to refrain from inefficient trespass if he can bargain. Therefore, O 's expected payoff equals $\omega [-E(c) + \frac{1}{2}\beta\Lambda]$. Hence her willingness to pay for title under a compensation regime is $V_L = (1 - \omega)[E(c) - \frac{1}{2}\beta\Lambda] > 0$.

With injunction, title enables O to stop pollution when she cannot bargain, and to allow it for a price when she can. Therefore, her expected payoff equals $\frac{1}{2}\beta\Pi$. Hence her willingness to pay for title under injunctive relief is $V_P = E(c) + \frac{1}{2}(\Pi - \Lambda)$.

The difference in the willingness to pay for legal ownership generated by injunction relative to compensation equals $V_P - V_L = \frac{1}{2}\beta\Pi + \omega[E(c) - \frac{1}{2}\beta\Lambda] > 0$, which is increasing in ω . It is also increasing in β if and only if $\omega < \Pi/\Lambda$.

Proof of Proposition A4

With injunction, P is deterred from trespassing unless he can bargain with O and buy her permission. Hence, his expected payoff is $\frac{1}{2}\beta\Pi$ irrespective of his power. Since power does not increase P 's payoff, he never invests in acquiring it.

With compensation, if P is weak he is induced to act optimally and his expected payoff equals the social value of efficient action Π . If P is strong he trespasses when $c < b$ and gets O to pay him not to trespass when $c > b$. Therefore, he invests in power if and only if $i < \bar{i} = b - \Pi + \frac{1}{2}\beta\Lambda$.

Proof of Proposition A5

When polluters can invest in power, the expected social surplus from compensation equals $\Pi - F(\bar{i})[(1 - \beta)\Lambda + E(i \mid i < \bar{i})]$. The expected social surplus from injunction equals $\beta\Pi$.

The difference in the expected social surplus from compensation and injunction is $\Delta = (1 - \beta)\Pi - F(\bar{i})[(1 - \beta)\Lambda + E(i \mid i < \bar{i})]$. Hence, compensation is socially optimal if and only if $\Lambda < \tilde{\Lambda}$. If $\Delta > 0$ for $\Lambda = 0$, the threshold $\tilde{\Lambda}$ is defined by $\Delta = 0$. Since $\partial\Delta/\partial\beta = -[\Delta + F(\bar{i})E(i \mid i < \bar{i})]/(1 - \beta) - f(\bar{i})[(1 - \beta)\Lambda + \bar{i}]\partial\bar{i}/\partial\beta < 0$ when $\Delta = 0$, by the implicit-function theorem $\partial\tilde{\Lambda}/\partial\beta < 0$. If $\Delta \leq 0$ for $\Lambda = 0$, the threshold is $\tilde{\Lambda} = 0$.

Proof of Proposition A6

A pure compensation regime accommodates all efficient pollution, but it also enables inefficient pollution by a powerful P when the true victim cannot bargain. Thus, expected social surplus is $W_0 = \Pi - [(1 - \beta\delta)p_1 + (1 - \beta)(1 - p_1)]\omega\Lambda$.

If O_1 alone is entitled to an injunction, she reaches the first best when everyone can bargain. When she cannot bargain, she allows efficient pollution only when she is not harmed, and even so with probability $1 - \varepsilon$. Inefficient pollution by a powerful P is enabled with probability $1 - \varepsilon$ if bargaining is impossible and O_1 is unharmed. Thus, expected social surplus is $W_1 = [\beta\delta + (1 - \beta\delta)(1 - \varepsilon)(1 - p_1)]\Pi - (1 - \beta)(1 - \varepsilon)(1 - p_1)\omega\Lambda$.

If O_2 alone is entitled to an injunction, she also allows pollution under analogous conditions. In addition, she allows inefficient pollution by a powerful P whenever she is unharmed and can bargain while the true victim cannot. Thus, expected social surplus is $W_2 = [\beta + (1 - \beta)(1 - \varepsilon)p_1]\Pi - [(1 - \beta)(1 - \varepsilon) + \beta(1 - \delta)]p_1\omega\Lambda$.

If both O_1 and O_2 are entitled to an injunction, they prevent all inefficient action, but they also prevent efficient action if the true victim cannot bargain, and with probability ε even if she can but the other agent cannot. Thus, expected social surplus is $W_{12} = \beta[\delta + (1 - \delta)(1 - \varepsilon)(1 - p_1)]\Pi$.

To simplify notation, normalize $\Pi = 1$ and define $\Omega = \omega\Lambda/\Pi \geq 0$. Then the four expected surpluses W_0 , W_1 , W_2 and W_{12} are affine functions of Ω with $\partial W_0/\partial\omega < \partial W_2/\partial\omega < \partial W_1/\partial\omega < \partial W_{12}/\partial\omega = 0$ and such that $W_0 > W_2 > W_1 > W_{12}$ for $\Omega = 0$.

$W_0(\Omega) > W_2(\Omega)$ if and only if $\Omega < 1$ and $W_{12}(\Omega) > W_2(\Omega)$ if and only if $\Omega > \Omega_{12} = 1 + (1/p_1 - 1) / [1 + (1/\beta - 1)(1/\varepsilon - 1)/(1 - \delta)]$ such that $\partial\Omega_{12}/\partial\beta > 0$, $\partial\Omega_{12}/\partial\delta < 0$, $\partial\Omega_{12}/\partial\varepsilon > 0$ and $\partial\Omega_{12}/\partial p_1 < 0$.

$W_{12}(\Omega) > W_1(\Omega)$ if and only if $\Omega > 1$. Thus, $W_1(\Omega) < \max\{W_2(\Omega), W_{12}(\Omega)\}$ for all $\Omega \geq 0$.