A Model of Environmental Compromise Between Regulators and Regulated Parties

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Abstract

Environmental regulations implemented by administrative agencies have often been met with fierce political resistance from regulated parties. In some instances, regulated parties have turned to legislative and judicial bodies for relief from environmental regulation. As these political and legal battles have escalated, several forms of compromises have evolved. The U.S. Fish and Wildlife Service, in its administration of the Endangered Species Act, has often utilized the tool of "Habitat Conservation Planning" as a means by which some regulatory relief is granted in exchange for an agreement by the regulated party to undertake mitigation measures to aid endangered or threatened species. As a further inducement for regulated parties to enter into the Habitat Conservation Planning process, the Service has also adopted a "No Surprises" policy of guaranteeing regulated parties that if certain additional mitigation measures are taken, then if in the future any further mitigation measures are deemed necessary to protect endangered or threatened species, they will only be undertaken at the expense of the Service. This paper develops simple models of the conditions under which such compromise agreements are offered by a regulator, and the conditions under which the regulated party either accepts such an offer or pursues a strategy of appealing to legislative or judicial bodies for relief from regulation.

Introduction

Through litigation and aggressive legislative lobbying, property rights advocates and landowners affected by environmental and land-use planning regulations have mounted some successful challenges to the administrative authority of local, state and federal regulators. Some landowners have sued regulators to force them to rescind or modify a regulation, and in some cases, force them to pay compensation for a regulatory "taking" of private property under the Fifth Amendment of the U.S. Constitution. While landowners' successes have been far from complete, several of their noteworthy victories have significantly influenced regulatory behavior. Also, in state and federal legislatures, property rights advocates have enjoyed some success in urging for “takings” legislation, which typically provide that regulations resulting in a diminution in private property value in excess of some threshold amount shall trigger a requirement that the regulating agency compensate the property owner. Again, while some bills have passed and some have failed, the mere fact that these bills made their way onto the legislative agenda has resulted in some discernible leniency on the part of regulators.

Engaging in legislative and judicial conflicts, however, is costly. Some regulatory agencies have forged regulatory compromises with regulated parties. The U.S. Fish and Wildlife Service (the “Service”), the agency with primary responsibility for administration of the Endangered Species Act (the “ESA”), has been the target of litigation filed by property rights advocates and landowners affected by ESA regulations, and the subject of some hostility within Congress. As pressure for ESA reform has intensified, the Service has responded by utilizing Habitat Conservation Plans (“HCPs”) to develop regulatory compromises. HCPs are voluntary agreements between the Service and landowners affected by the ESA, whereby a landowner agrees to undertake specific mitigation measures on her property in exchange for an “Incidental

Take Permit," which authorizes her to pursue activities harmful to listed endangered or threatened species that would otherwise be prohibited by the ESA. While the HCP process has been in place since 1982, the Service has only recently begun to use HCPs extensively.

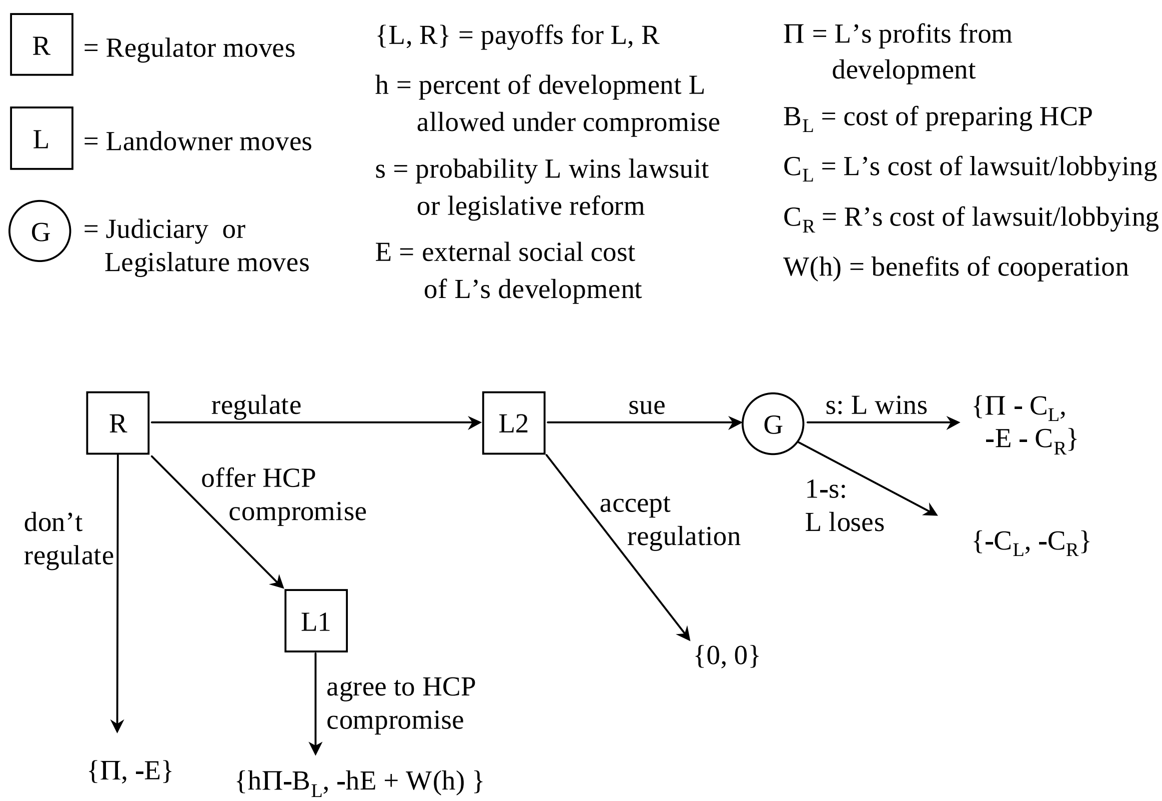
Another compromise-oriented policy that the Service has adopted is the "No Surprises" policy, which has been conveniently folded into the HCP process. In the interests of long-term habitat conservation planning, most HCPs are now more comprehensive but contain "No Surprises" assurances to the landowner she will not be asked to undertake any further mitigation measures deemed necessary in the future to preserve listed species. No Surprises assurances are most important in cases where the landowner agrees to undertake mitigation measures significantly beyond those required for the HCP, typically for species that have yet to become listed as endangered or threatened, or for species that do not yet occupy the area covered by the HCP. If, in the future, such species become listed or move into the area covered by the HCP, the No Surprises assurances protects the landowner from any obligation to undertake more mitigation measures. Landowners thus trade profits for certainty, a tradeoff that they appear to have gladly accepted. Also, both sides benefit from the advance settlement of a conflict that might otherwise require substantial resources to resolve in a judicial or legislative setting.

Following Segerson and Miceli, this paper models the HCP process and the No Surprises process as dynamic games of symmetric information and sequential rationality. Each game has two risk-neutral players, Regulator, ("R") and Landowner ("L"). L maximizes expected private profits and R maximizes the expected wealth of society, but does not take into account L's welfare. Each game has an extra-executive branch of government that may grant regulatory relief to L, should L seek it. In addition, in the No Surprises model there is a nonzero probability that additional mitigation measures will become necessary in the future to protect listed species.

The HCP Model

In the HCP model (fig. 1), the first move is made by the regulator R: she has a choice of: (i) imposing a regulation upon the landowner L, (ii) not imposing the regulation, or (iii) offering L an HCP compromise. If R opts to not impose the regulation at all, L will obtain her full profits Π, and R will suffer E, the full external damage costs of L's development. If R offers L an HCP

Figure 1. HCP model



compromise and L accepts (in a symmetric information game there is no reason for R to offer a compromise that L will not accept -- hence there is no branch of the game tree representing L's refusal of a compromise), then L only develops the fraction h of her land, and obtains partial profits $h\Pi$, while R suffers only partial damages, hE, and garners any benefits of cooperation that may accrue from the compromise, $W(h)$, such as information-sharing benefits. L is assumed to bear the costs of preparing and implementing an HCP, B_L. If R opts to regulate, then L may: (i) accept the regulation and refrain from development, or (ii) seek regulatory relief from outside the agency, by either suing R or lobbying for legislative relief. For expositional purposes, however, I collapse the litigation and legislative strategies into a composite one, which I refer to for the sake of convenience as simply "litigation" or "L sues R," or some equivalent phrase.

If R opts to regulate and L accepts the regulation, payoffs are zero for both R and L -- L obtains no profits, and R suffers no external damage costs. If L sues R, an extra-executive branch will rule in favor of L with probability *s*. L's expected payoff if she sues will therefore be $s(\Pi-C_L)+(1-s)(-C_L) = s\Pi-C_L$, while R's expected payoff will be $s(-E-C_R)+(1-s)(-C_R) = -sE-C_R$.

Games of symmetric information are solved by backward induction (Rasmusen, p. 94). If we solve the HCP model in this manner, we can reduce the HCP game into three cases:

$s\Pi-C_L < 0$. If faced with regulation, L will not sue, because the payoffs of simply accepting the regulation are greater. R knows this, and will regulate without fear of being sued.

$s\Pi-C_L > 0$ and $-E > -sE-C_R$. R knows that L will sue, and L knows that R would rather suffer the full external damages rather than face litigation. R will not regulate in this case, so L will fully pursue her development plans without fear of regulation.

$s\Pi-C_L > 0$ and $-E < -sE-C_R$. Both L and R are willing to litigate. But if we assume that $C_L+C_R > B_L$ (i.e., the combined costs of litigation are greater than the costs of preparing an HCP), then there will *always* exist an *h* such that both L and R are better off compromising rather than allowing the situation to degenerate into litigation, even if we assume that $W(h)=0$. Thus, in this case, there will *always* emerge a compromise in the form of an HCP.

The HCP model poses interesting empirical questions, such as the actual values of *h* that are observed in HCPs. Because of our assumption of sequential rationality, the HCP model predicts that if R wanted to compromise, she would offer L as small an h as possible that still induces her to accept a compromise, or that $h\Pi \geq s\Pi-(C_L-B_L)$. The smallest h possible is thus:

$$h=s-(C_L-B_L)/\Pi \qquad \textbf{(1)}$$

However, if the model were changed so that L moved first, then we would expect L to offer to carry out an HCP with the maximum h acceptable to R, or such that $-hE \geq -sE-C_R$, or

$$h=s+C_R/E \qquad \textbf{(2)}$$

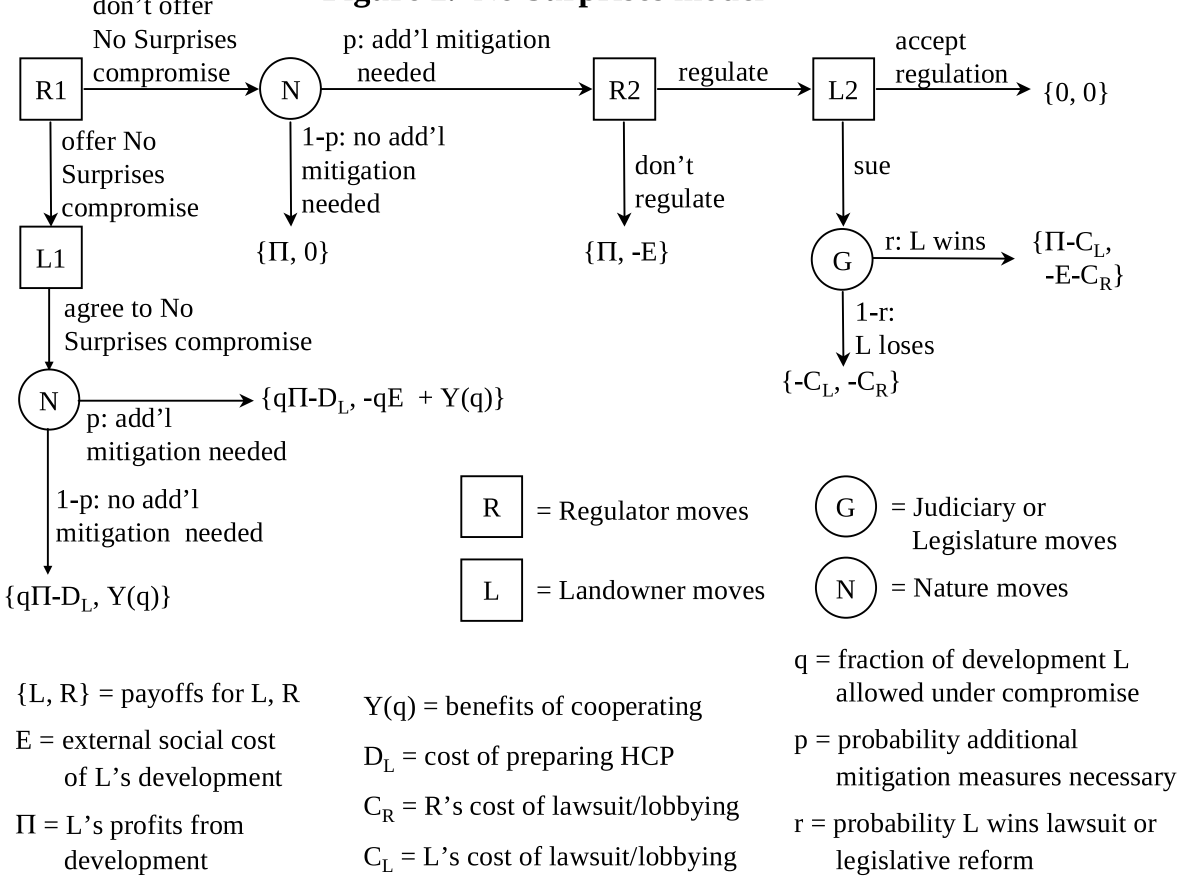
Whether h is closer to the minimum or maximum possible values is an empirical question, and tells us whether L or R is more adept at negotiating and capturing the gains from trade. This can be accomplished by determining whether h varies with E or Π, and thus whether equation (1) or (2) is the correct model. If R is capturing the gains from trade, then $\delta h/\delta\Pi=(C_L-B_L)/\Pi^2 > 0$ and $\delta h/\delta E=0$. If L is capturing the gains from trade, then $\delta h/\delta\Pi=0$ and $\delta h/\delta E=-C_R/E^2 < 0$. To understand these results, it is necessary to imagine an Edgeworth box in which L and R have scope for trade. If R is appropriating the gains from trade, then the values of h of the various HCPs will lie along the landowner's indifference curve. As Π increases, L's indifference curve will shift outward, and the value of h will increase along with Π. On the other hand, if L is appropriating the gains from trade, then the values of h for the various HCPs will lie along R's indifference curve, and as R's indifference curve shifts inwards with higher values of E, h will shift inwards along with it.

Equations (1) and (2) also yield the comparative static result $\delta h/\delta s=1$, indicating that as the probability of a successful lawsuit by L increases, so does the fraction of property that R will allow L to develop. This is a fundamental result of this model, as it formalizes the hypothesis that landowners are converting their political and judicial leverage into regulatory relief.

The No Surprises Model

The No Surprises model (fig. 2) presupposes the existence of an HCP. Except for Π and E, the same notation is used in both models when the variables are likely to take on similar values. For example, litigation costs are probably the same whether the lawsuit occurs at the HCP stage or at the No Surprises stage, so they are denoted C_R for the regulator and C_L for the

Figure 2. No Surprises model



landowner in both models. However, the baseline values for Π and E are assumed to be that which is achieved after an HCP, i.e., L's and R's payoffs of compromise in the HCP game, $h\Pi\text{-}B_L$ and $-hE$ respectively, are transformed to Π and 0, respectively, in the No Surprises game.

At the beginning of the No Surprises game, both R and L know that at some future time

Nature will determine whether additional mitigation measures (beyond those already agreed to and carried out under the HCP) will be necessary to save listed species; this will occur with probability p. The No Surprises model begins with a decision by R as to whether or not to offer a No Surprises compromise. As in the HCP model, R will not offer L a compromise unless R knows L will accept. If the parties compromise, L will develop the fraction q of her property, and obtain partial profits of $q\Pi$. R's payoffs of compromise are probabilistic -- if additional mitigation measures (beyond those specified by the HCP) become necessary in the future, then R's payoff will be -qE; if they do not become necessary, R suffers no loss at all and her payoff is zero. R's expected payoff of compromise is thus $p(-qE)+(1-p)0 = -pqE$. R also obtains the benefits of compromising, $Y(q)$.

This game is also solved by backward induction. L's expected payoff if she sues R is $r(\Pi-C_L)+(1-r)(-C_L) = r\Pi-C_L$, and R's expected payoff is $r(-E-C_R)+(1-r)(-C_R) = -rE-C_R$. As in the HCP model, folding back the game tree again gives rise to three cases:

$\boldsymbol{r\Pi-C_L < 0}$**.** L will not sue. Knowing this, R will not compromise. If additional mitigation measures become necessary in the future R will require L to undertake them.

$\boldsymbol{r\Pi-C_L > 0}$ **and** $\boldsymbol{-E > -rE-C_R}$. R will sue, and L will wish to avoid litigation. Since both sides know this, L will refuse any compromise and fully develop her property, knowing that if additional mitigation measures become necessary R will not attempt to impose them upon L.

$\boldsymbol{r\Pi-C_L > 0}$ **and** $\boldsymbol{-E < -rE-C_R}$**.** L will sue, and R will regulate, taking her chances with L's lawsuit. However, R will offer a No Surprises compromise if there exists some q such that the expected payoffs of compromise are greater than the expected payoffs of litigation for both R and L. This is true if:

$$q\Pi-D_L > (1-p)\Pi + p(r\Pi-C_L) \quad \text{(for L)} \quad \text{and}$$

$$-pqE + Y(q) > p(-rE-C_R) \quad \text{(for R)}$$

If we make the simplifying assuming that $Y(q)=0$ (a reasonable one, since the benefits of compromising are speculative), combining these conditions by solving q out yields:

$$(1-r)(1-p) < C_R/E + (pC_L-D_L)/\Pi \qquad \textbf{(3)}$$

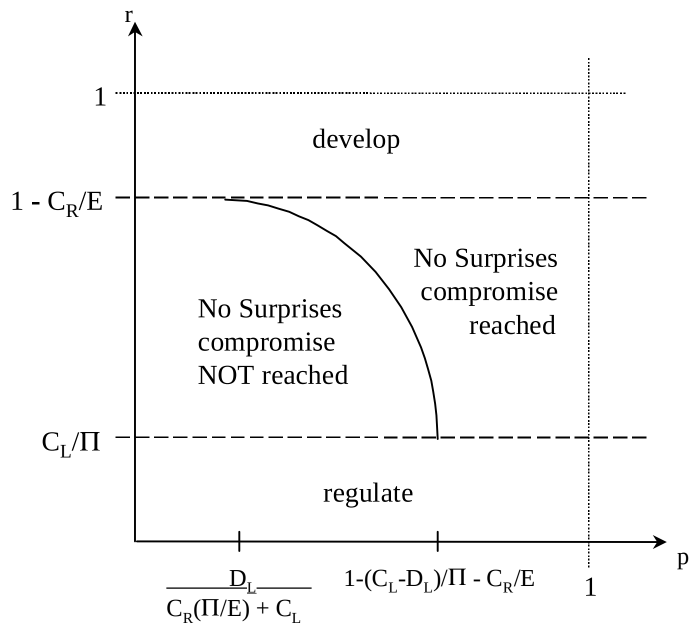
Condition (3) is a necessary (but not sufficient) condition for a compromise. The relationship between the three cases and condition (3) is expressed by a graph in r-p space (fig. 3).

If the probability *r* of L winning a lawsuit against R are high enough or low enough, then the probability of future mitigation measures becoming necessary are irrelevant, since there is no uncertainty as to how the parties will react – either L or R will bow to the other's will, giving rise to the "develop" and "regulate" regions in figure 3. If *r* assumes some intermediate value, however, such that both L and R would be willing to litigate, then there is a chance that the parties will compromise; whether they do or not depends on the values of both *r* and *p*.

For $p > 1-(C_L-D_L)/\Pi-C_R/E$ (this condition is obtained by setting $r=C_L/\Pi$ and solving for *p*), there will always emerge a compromise. To understand this result it is necessary to recall that in the HCP model, if the combined costs of litigating are greater than the costs of preparing an HCP, compromising is always better than litigating. If the same assumption is made in the No Surprises model ($C_L+C_R>B_L$), both parties know that in this intermediate case of *r* (where both parties are willing to litigate), if additional mitigation measures are deemed necessary in the future, L and R together will incur the cost $C_L+C_R-D_L$ relative to a No Surprises compromise. If the probability *p* of this happening is high enough, L and R will compromise to avoid this contingency. Generally, the higher the value of *p*, the greater the likelihood of a compromise.

For $p < D_L/[C_R(\Pi/E)+C_L]$ (this condition is obtained by setting $r=1-C_R/E$ and solving for *p*), there is no chance for a compromise. This is because the likelihood of further mitigation

Figure 3. Regulatory Outcomes in r-p Space.



measures becoming necessary in the future is so small it is not worthwhile for L to insure herself by agreeing to *any* additional mitigation measures now.

For the intermediate case $D_L/[C_R(\Pi/E)+C_L] < p < 1-(C_L-D_L)/\Pi-C_R/E$, a compromise becomes more likely the greater the value of *r*. This is because as *r* increases, L's expected payoffs of litigation *increases* by $p\Pi$, while R's expected payoffs of litigation *decreases* by pE, for a net social decrease of $p(E-\Pi)$, assuming $E>\Pi$. The less attractive litigation becomes, the more attractive a No Surprises compromise becomes.

The No Surprises model also presents interesting empirical questions. As in the HCP model, we may test to see if R or L is appropriating the gains from compromise, as well as test the most basic hypothesis of this paper, that the fraction of development increases with the probability of a successful lawsuit by L. In addition, we may derive comparative statics with respect to the probability of future mitigation measures becoming necessary.

Recall that for intermediate values of r (both R and L are willing to litigate) if a compromise is struck it means that L's expected payoffs from a compromise are greater than they are for taking chances with additional mitigation measures and ensuing litigation. As noted in the derivation of condition (3), this means that $q\Pi - D_L \geq (1-p)\Pi + p(r\Pi - C_L)$. If we assume that R offers L the minimum q possible that still induces L to accept a compromise, then the q that will be offered by R and agreed to by L is (assuming that $Y(q)=0$):

$$q = 1 - p + pr - C_L/\Pi + D_L/\Pi \qquad \textbf{(4)}$$

If, on the other hand, we assume that L is the first mover and offers R the maximum q possible that will still induce R to accept a compromise, then we have $-pqE \geq -prE - pC_R$, or

$$q = r + C_R/E \qquad \textbf{(5)}$$

If we take the derivative of (4) and (5) with respect to Π, E and r, we obtain the same comparative statics results as we obtained from (1) and (2) from the HCP model. In addition, (4) yields a relationship between q and p. Comparative statics results are summarized in table 1.

Table 1. Comparative Statics Results.

HCP Model		**No Surprises Model**	
R captures all GFT: $h = s-(C_L-B_L)/\Pi$	L captures all GFT: $h = s+C_R/E$	R captures all GFT: $q = 1-p+pr-(C_L-D_L)/\Pi$	L captures all GFT: $q = r+C_R/E$
$\delta h/\delta\Pi = (C_L-B_L)/\Pi^2$	$\delta h/\delta\Pi = 0$	$\delta q/\delta\Pi = (C_L-D_L)/\Pi^2$	$\delta q/\delta\Pi = 0$
$\delta h/\delta E = 0$	$\delta h/\delta E = -C_R/E^2$	$\delta q/\delta E = 0$	$\delta q/\delta E = -C_R/E^2$
$\delta h/\delta s = 1$	$\delta h/\delta s = 1$	$\delta q/\delta r = p$	$\delta q/\delta r = p$
		$\delta q/\delta p = -1+r$	$\delta q/\delta p = 0$

As table 1 indicates, both the HCP model and the No Surprises model yield dual hypotheses that allow us to ascertain if R or L is capturing the gains from trade in a compromise by testing to see if the fraction of development allowed varies with Π or E. These comparative statics results also allow us to check for consistency of the models, in that it should always be true that $\delta h/\delta \Pi \geq 0$ and $\delta h/\delta E \leq 0$. These results make sense because they reflect the increasing marginal values that the parties place on gaining more favorable terms of compromise. The higher the overall profits of the development project, the greater is the value of an extra unit of land to L. Similarly, the higher the external social damages of development, the greater is the value to R of preservation of an extra unit of land. Both models also provide a means for testing the most fundamental tenet of this paper, that the terms of compromise are affected by the probability of L successfully obtaining extra-executive redress through suing or through seeking legislative reform. This is also intuitive, in that the more leverage enjoyed by L, the more favorable a deal that L should receive in a compromise.

Also, in the No Surprises model, if we assume that R appropriates all of the gains from trade in a compromise, we also obtain the comparative static result $\delta q/\delta p < 0$, indicating that as the probability of future mitigation increases, the fraction allowed for development decreases. However, if we assume that L appropriates all of the gains from trade, we obtain the result $\delta q/\delta p=0$. This lack of symmetry can be explained by the manner in which the probability p enters linearly into R's payoff functions whether R compromises or not, whereas L's payoff of compromise does not depend upon p at all. In comparing payoffs, p will cancel out of both payoffs for R, but not for L. Were R were risk-averse, we would then expect to see more propensity by R to compromises, and perhaps more generous terms of compromise as p increases, or $\delta q/\delta p > 0$. At any rate, the No Surprises model allows us to test to see if R or L is forcing the other to bear the burden of uncertainty by demanding a higher or lower q.

Conclusion

The game-theoretic models presented in this paper may explain much regulator and landowner behavior with regards to ESA regulation, and provide some heuristic value to analyzing the regulatory bargaining process. Importantly, the model structures lend themselves to testable hypotheses. The most fundamental hypothesis is that as the probability of the landowner successfully obtaining regulatory relief increases, the fraction of development allowed by the regulator will increase as well. Also, both models generate dual hypotheses that either the landowner or the regulator is capturing the gains from trade in a compromise. If the fraction of development allowed varies with the external social damages, then we know that the landowner is capturing all of the gains from trade, forcing the regulator to walk along her indifference curve; if the fraction varies with the private profits of development, then the roles are reversed.

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