Stakeholder Engagement in Land Development Decisions: A Waste of Effort?

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Abstract

Currently, management devolution and engagement of local stakeholders - expected to have better information - is seen as key to effective environmental management. Often, the absence of clear property rights and/or supporting market institutions leaves management decisions to a political process. Where undeveloped land provides a public good, when to halt further development is modelled as a repeated lobbying contest between industry and households. Lobbying effort affects the continuation probability. Depending on how stakeholders are engaged, there may be little impact on final outcomes, or a lobbying war can be stimulated. Overall welfare is seldom enhanced.

Keywords: Stakeholder engagement, lobbying contest, public good, water conservation, land development

JEL: Q24, Q25, R14, R52

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1 Introduction

"Power to the people" is a mantra that has become an important theme in the environmental movement. A range of books and articles, ([33, 36] for example) argue that local environmental stewardship is the means by which our environmental problems must be addressed. Both governmental and non-governmental organizations are often strongly promoting such approaches, while critical analysis of these approaches are scarce, and are so far at best inconclusive about the outcomes. An area where this argument is particularly strongly presented is land use planning. Often, planning involves deciding whether or not a parcel of open space is going to be developed. Development can directly consume a resource that produces a local public good, such as open space, or more indirectly, such as leading to changed flows in local streams. In this paper a situation closer to the latter is modelled. A regulator retains final authority over whether or not to allow further development, while a pro- and anti-development lobby attempt to influence when development will be halted.

Although consumption of open space by development is probably the most publicized impact of sprawl, it is not obvious that substitution of a landscaped suburban yard for an agricultural field is destruction of a public good. In contrast, where development consumes water that would otherwise maintain stream flows, the destruction of the public good is more apparent. We focus on this type of situation here. Some efforts have been made to value instream flows (examples include [9, 12, 11, 28]), often using contingent valuation. A general result of all this literature is that below a certain level, reductions in stream flow reduce the public good value of the stream. This type of public good is the focus of the current analysis.

Another branch of literature examines mechanisms that can be used to secure instream flows ([17, 6, 32, 16, 8] among others), while [25] documents a few cases where incentive based approaches have been actually applied. Game theoretic approaches in this literature have largely been restricted to bargaining models, where at least one dimension of the bargaining includes instream flows [1, 38, 7]. Dynamics are generally restricted to elements of the physical processes. These models are mostly built to inform policy makers, rather than analyzing the process itself.

Although enabling or forcing stakeholders to directly engage each other is relatively novel, stakeholders have traditionally been involved in water negotiation processes. Their effectiveness at promoting their interests is related to their effort, succinctly commented on by [29, p343] "... only those with sufficiently concentrated costs or benefits, who attend hearings and committee meetings or make large campaign contributions will be heard." As Loomis argues, valuation studies are one way to measure the impacts on those not active in the process. However, many argue that engagement is preferable to valuation studies. Participation should therefore be made less costly, or failure to participate made more costly. 'Stakeholder engagement', 'participatory management,' and other such approaches are perhaps best interpreted as efforts to change the costs and benefits of involvement in the decision process. The results of the rather limited analysis of such approaches is mixed [3, 26, 42, 23, 30, 39]. Participants express a greater appreciation for others' situation, and suggest they are more willing to cooperate. However, there is little evidence of behaviour change, and some suggestion that people engage in the process to delay regulatory change, rather than to participate in shaping that change. In the model below, two aspects of the participation process are considered, the effectiveness of lobbying effort and the responsiveness of the regulator to that effort. Greater effectiveness and responsiveness are akin to increasing the potential benefit of participation to the stakeholders.

The relationship between households and developers has been explored. Fischel [13, 14] argues that local politics is heavily influenced by 'homevoters' who participate out of fear that the value of their most important asset, their home, may decrease. Henderson and Becker [19] reviews a number of models of city development, and decides that the most appropriate has cities first built by development firms and then turned over to a government. Managing development to maximize citizen welfare only happens after there are citizens present. Lubell et al. [31] discusses several models, particularly the contrast between a property rights model - where scarcity drives a demand for property rights over that which is scarce - against interest group models - the 'Growth Machine' - and the political market - where interests try to buy the regulator. Success in achieving conservation objectives depends on both the power of the interest groups and the institutional form. As evidence, conservation is generally less where developers are the most powerful, while it is greatest where population pressures are higher.

Much research has looked at the role of lobbying in government decision-making. In what follows we focus on a particular stream of this literature, the rent seeking contest model started by Tullock [40, 41]. Tullock is credited with being the first to conceptualize lobbying as investing to affect the probability of capturing a prize. In the static case with Tullock's specification, the Nash equilibrium always involves wasteful spending on lobbying. Linster [27] showed that when the contest is infinitely repeated, this need not be true. Dijkstra [10] found that interest groups may prefer regulation over a financial instrument if lobbying over use of revenues exhausts potential payouts. Graichen et al. [15] showed that it may be optimal for firms to improve their environmental behaviour if it reduces the likelihood that an environmental lobby can become a substitute. Ironically, environmental and consumer lobbies may be working in opposite directions in such situations. This paper implements a Tullock style lobbying game in a dynamic land development context, where development consumes a public good, akin to instream flow.

2 Model

We consider a model where community members - households - and firms both can participate in a negotiation or lobbying process. Participation is costly to both households and firms. Although the terms 'lobbying' and 'negotiation' have almost contradictory normative connotations, for our purposes the key issue is that engagement is costly, but engagement does influence outcomes. The terms will therefore be used somewhat interchangeably. The negotiation is over whether or not to allow more of a scarce resource essential for community growth - land or instream water - to be developed. Undeveloped, the scarce resource produces a public good. When used, this developed land provides accommodation for members of the community. Thus, development increases the size of the community, and thereby the marginal public good value of further consumption of the resource.

To be specific, let $\overline{w}$ be the total amount of the resource that can be developed, z_t the amount left undeveloped at t, and q_t (q_{it} for each firm) the amount that is developed in t. The public good and population are both normalized to the same units as z_t, so that at the beginning of a period, population is $\overline{w} - z_t$. Development occurs at the beginning of the period, after which the public good is enjoyed. Thus, the population in period t, after q_t units of land are developed, is $\overline{w} - (z_t - q_t)$. This is the population able to enjoy the public good in that period, and will be labelled m_t when

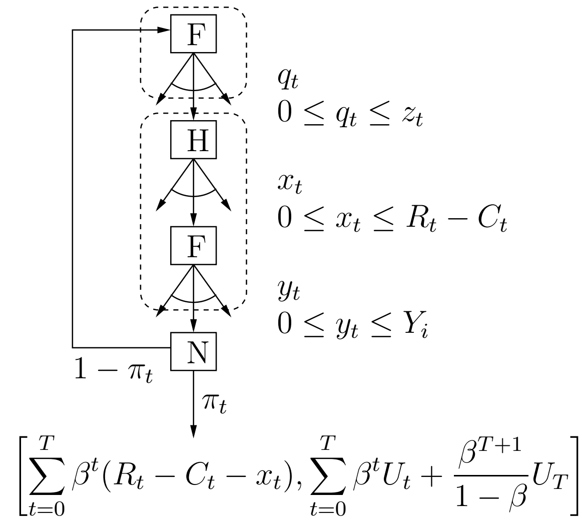

Figure 1: Game Tree. Firm payoff when the game ends is the present value of profits from house sales, less lobbying cost, to the point where development ends. For households, payoff is the present value of the utility stream earned while development occurs, and the present value of the permanent level of utility earned after development stops.

this is convenient. At the end of the period, firms choose an amount x_{it} to devote to the negotiation process, and households choose an amount y_{jt}. The regulator's decision process is probabilistic, as in a Tullock game, with the probability of a halt in further development given by $\pi(x_t, y_t)$, with x_t and y_t being the total negotiation effort for firms and households. It is assumed that $\pi_1 < 0$ and $\pi_2 > 0$, where subscripts indicate partial derivative arguments. Once development of the resource stops, it never resumes.

There are n identical firms, with period profit given by

$$p_t(m_t)q_{it} - c_t(q_{it}) - x_{it} \tag{1}$$

where $p_t()$ is the price that a unit of the resource commands and $c_t(q_t)$ is the cost to the firm of developing q_t units. The demand curve satisfies $p_t' < 0$ and $p_t'' \ge 0$, while the cost function satisfies $c_t' > 0$ and $c_t'' > 0$. The resource is durable, in that each consumer only consumes one unit, which provides indefinite service. Demand therefore depends on total development (population, $m_t = \overline{w} - (z_t - q_t)$), not period development (immigration, q_t). This is consistent with land, or annual rights to a finite renewable resource like water. For each household, period utility is given by

$$u(z_t, Y_i - y_{it}) \tag{2}$$

where Y_i is an exogenously given income for household i. Standard assumptions are satisfied, with $u_1 > 0$, $u_{11} < 0$, $u_2 > 0$ and $u_{22} < 0$. Note that this is the utility of a resident who owns a house, with the price paid for the house treated as a sunk cost. For simplicity, the demand for houses is assumed to be independent of the level of the local public good supplied by undeveloped land. House price and the utility of residents is therefore independent - we are concerned with utility of residents after purchasing a house. A visual representation of the game is shown in figure 1.

Determining the optimal development path and stopping point requires accounting for firm profits and household utility. If profits of the development industry leave the community, so that accounting for them consists of ignoring them, then the optimal community size and public good level are found, for any initial z_t, by solving

$$[\beta/(1-\beta)] \max_{q_t} \{u(z_t - q_t, Y_i)m_t\} \tag{3}$$

the present value of an annuity generating $u(z_t - q_t, Y_i)m_t$ aggregate utility indefinitely, with discount factor β. The first order condition is $u_1 = u/m_t$, or marginal utility equals average utility. Thus, not surprisingly, the optimal community size is that which maximizes average utility. The dynamic nature of the problem is irrelevant, as the driver for an optimal path over time is the cost function. This is borne by the firms, and therefore ignored in this case. The utility maximizing solution is to simply set the community at its optimal size immediately. The only dependence on the current level of development, z_t, is that if z_t is smaller than the optimal undeveloped resource level, no further development occurs.

The polar opposite is to consider only firm profits and ignore household utility. We are then focused only on the firm, which seeks to maximize the present value of profits from development. In the form of a recursive relationship, the value of a firm is

$$V_t(z_t) = \max_{q} \{p_t(\overline{w} - (z_t - q_t))q_{it} - c_t(q_{it}) + (1-\pi)\beta V_{t+1}(z_t - q_t)\} \tag{4}$$

where π is an exogenous probability that further development will not be permitted after the current period. In period t, the equilibrium (assuming symmetric firms) condition is

$$(q_t/n)p'_t + p_t - c'_t = (1-\pi)\beta V'_{t+1} \tag{5}$$

Firms equate the marginal benefit of current development to the discounted expected marginal benefit of delay. Increasing the number of firms generates more development in t (recall that $p'_t < 0$).

A social optimum that considers both households and firms must combine utility and profits. If we let firms be owned by households, and, in the spirit of the Hartwick rule [18], profits can be invested to generate a payoff in perpetuity (no depreciation), a third optimization can be performed. Following Bellman's principle of optimality [4], and assuming that all profits are distributed equally among households, the recursive equation that characterizes the optimal path is

$$U(k_t, z_t) = \max_{q_t} \{u(z_t - q_t, Y_i + (1-\beta)k_t/m_t)m_t + \beta U(k_{t+1}, z_{t+1})\} \tag{6}$$

where $z_{t+1} = z_t - q_t$, and $k_{t+1} = p_t(m_t)q_t - c_t(q_t) + k_t$. The new state variable, k_t, is the accumulated profit from development activities, which generates a return at $(1-\beta)$ that is shared equally among the population m_t. The first order condition is

$$u_t - u_{1,t}m_t - (1-\beta)(k_t/m_t)u_{2,t} = \beta(p'_t q_t + p_t - c'_t)U_{1,t+1} - \beta U_{2,t+1} \tag{7}$$

where with two subscripts, the first indicates argument of derivative and the second the time period at which the arguments are evaluated. The marginal benefit of increasing development in period t is the utility earned by the addition to the population, less the public good loss and capital dilution impacts. This is set equal to the present value of the marginal benefit of delay, which includes the impacts of the higher price and profit next period and the greater level of the public good.

Introducing lobbying or negotiation demands that households and firms be considered simultaneously. Further, if either type of agent is to lobby, there must be a benefit to doing so. Here, this is the impact on the probability development stops after the current period, $\pi(x_t, y_t)$, where $x_t = \sum x_{it}$ and $y_t = \sum y_{jt}$ are the total lobbying efforts of the households and firms. The two recursive equations that characterize this system are

$$\begin{aligned} V(z_t) &= \max_{q_{it}, x_{it}} \{p_t(\overline{w} - (z_t - q_t))q_{it} - c_t(q_{it}) - x_{it} \\ &\quad + (1 - \pi(x_t, y_t))\beta V(z_t - q_t)\} \qquad (8) \\ U(z_t) &= \max_{y_{jt}} \{u(z_t - q_t, Y_j - y_{jt}) \\ &\quad + \pi(x_t, y_t)\beta^2/(1-\beta)u(z_t - q_t, Y_j) + (1 - \pi(x_t, y_t))\beta U(z_t - q_t)\} \qquad (9) \end{aligned}$$

Two key points are highlighted in these recursive relationships. First, if development stops, then the firm earns no further profits. Second, for the household, if development stops, households earn the present value of $u(z_t - q_t, Y_j)$, a consequence of the fact that the public good level remains at $z_t - q_t$ forever, and that no further spending on negotiation is required. The annuity factor is $\beta/(1-\beta)$.

Some basic results of this formulation can be explored by examining the first order conditions. The first order conditions for x_{it} and y_{jt} define the best response functions of the two types of players. These are

$$-1 - \pi_{1,t}\beta V_{t+1} = 0 \qquad (10)$$

$$-u_{2,t} + \pi_{2,t}\beta\left[\beta/(1-\beta)\overline{u}_t - U_{t+1}\right] = 0 \qquad (11)$$

For the firms, the marginal probability scaled next period value is equated with the marginal lobbing cost, 1. For households, current marginal utility loss is equated to marginal probability scaled net benefit if development stops, the difference between $\overline{u}_t = u(z_t - q_t, Y_i)$ and $U(z_t - q_t)$. A lobbying war occurs when the resultant x_t and y_t values are larger than the change in welfare relative to the equilibrium that would occur without lobbying.

For both types of agents, two forces interact to influence whether and how much it is worth engaging in negotiations. For firms, these are the size of V_{t+1} and the marginal impact on the probability. If the firm value is large, then the value of negotiating to allow further development is high. Likewise, if the impact on the probability is large, then the value of negotiating is high. With housing a durable good, it follows that $V'_{t+1} < 0$. As more housing is sold, the price of housing, and therefore future profits, falls. This implies that industry lobbying effort will decline over time, as the stock of housing grows (as the stock of the public good shrinks).

For households, the marginal impact on π interacts with the expected utility impact of future development, $\beta/(1-\beta)\overline{u}_t - U_{t+1}$. A greater probability impact, the more it is worth spending. Likewise, the greater the expected utility impact - due to future reductions in the public good, the more effort put into negotiations. Therefore, if the public good has diminishing marginal value to households, then household lobbing effort will increase over time, as the amount of remaining public good shrinks. Taken together, this implies that as the game proceeds, industry lobbying declines and household lobbying increases. Thus, the probability that the game ends after the current period increases with time.

The end of period lobbying game Nash equilibrium generates two functions $x^*_t(q_t)$ and $y^*_t(q_t)$.

Table 1: Negotiating Game Equilibria. Households (H) choose y and firms (F) choose x. In equilibria, either households or firms fold, or the system moves in the direction of a lobbying war. Within two cells, the outcome is indeterminate as it depends on the precise relationships, not simply the signs.

	$y_t^{*\prime} \ll 0$	$y_t^{*\prime} < 0$	$y_t^{*\prime} > 0$	$y_t^{*\prime} \gg 0$
$x_t^{*\prime} < 0$	$q_t \uparrow$, H fold	$q_t \downarrow$, to war	$q_t \downarrow$, indet.	$q_t \downarrow$, F fold
$x_t^{*\prime} > 0$	$q_t \uparrow$, H fold	$q_t \uparrow$, indet	$q_t \uparrow$, to war	$q_t \downarrow$, F fold

Assuming perfect information, these functions are included in the firms choice of q_t at the beginning of the period. The first order condition for this optimization leads to the equilibrium condition

$$\underbrace{p_t' q_t/n + p - c_t'}_{MNR} - \underbrace{x_t^{*\prime}/n}_{ML} = \underbrace{(1-\pi)\beta V_{t+1}'}_{MFC} + \underbrace{(\pi_1 x_t^{*\prime} + \pi_2 y_t^{*\prime})\beta V_{t+1}}_{MLI} \tag{12}$$

with symmetry assumed. The four components of this relation are here labelled marginal net revenue (MNR), marginal lobbying (ML), marginal future cost (MFC) and marginal lobbying impact (MLI). With a probability π that development will end after the current period, and no lobbying game, q_t occurs where $MNR = MFC$. How this outcome is shifted by the lobbying game depends on how ML and MLI interact. This depends on the behaviour of x_t^* and y_t^*, and how that interacts with π, where $\pi_1 < 0$ and $\pi_2 > 0$.

Since both x_t^* and y_t^* can be either decreasing or increasing, there are four possible combinations (see table 1). Absent the MLI effects, when $x_t^{*\prime} > 0$, q_t is reduced, as firms reduce development to reduce the resulting lobbying cost. When MLI is positive, which occurs for a sufficiently large and positive $y_t^{*\prime}$, this effect is enhanced. Development, q_t falls as firms are seeking to avoid engaging in a lobbying war, firms 'fold'. For all remaining values of $y_t^{*\prime}$, MLI is negative, and q_t is increased. For large and negative values of $y_t^{*\prime}$, the increase in q_t causes a larger drop in y_t^* than the increase in x_t^*, essentially households 'fold'. When $y_t^{*\prime}$ is small in absolute value, increasing q_t may move the system in the direction of a lobbing war. This is certain for $y_t^{*\prime} > 0$, and can also be said to occur if $y_t^{*\prime} < 0$ but $x_t^{*\prime} + y_t^{*\prime} > 0$. The choice of q_t induces an increase in total lobbying effort. Note that since these are marginal effects, whether firms and households are actually engaged in a wasteful lobbing war cannot be determined from the signs alone.

When $x_t^{*\prime} < 0$, and no MLI, then firms increase current development in order to reduce lobbying expenditures. With MLI negative, this effect is enhanced. This occurs when $y_t^{*\prime}$ is negative and large enough (in absolute value). Once again, households fold. Likewise, when $y_t^{*\prime}$ is large and positive, q_t is reduced. Lobbying effort by firms does increase, but the decline in q_t is sufficiently satisfying to the households that total lobbying falls, and we again say that firms fold. With intermediate values for $y_t^{*\prime}$, q_t falls and industry lobbing increases. When $y_t^{*\prime} < 0$, household lobbing also increases, and the system moves in the direction of a lobbying water. With $y_t^{*\prime} > 0$, whether or not the system moves towards a lobbying war depends on whether $x_t^{*\prime} + y_t^{*\prime} < 0$.

A key policy question is whether government has a role. At present, the role is often seen as facilitating negotiation by bringing stakeholders together. It is unclear whether such facilitation affects $\pi(x_t, y_t)$. It is likely to reduce the cost of participation for the stakeholders, which, all other things equal, would increase stakeholder resources devoted to negotiation. In so far as this increase in resources does not change the outcome, such efforts are doubly wasteful. At the first level, government resources are devoted to a process that accomplishes nothing. At the second level, these government resources leverage stakeholder resources, which again accomplish nothing.

Thus, this suggests that government should not be devoting resources to facilitating the negotiation process. Rather, resources should be directed at understanding the relative strength in the current process, and looking for ways to shift that balance which increases the likelihood of increasing aggregate welfare. The objective therefore is to change $\pi(x_t, y_t)$. This may involve funding targeted at strengthening community groups - the household lobby in the model. Funding should directly address where the weakness is in the household influence on $\pi(x_t, y_t)$ - overcoming the free rider problem, supporting local research, providing expertise, etc. Unfortunately, it is expected that any such shifts would themselves be subject to some level of political negotiation.

3 Numerical Example

A numerical example is developed in R [34]. Function definitions are

$$u_t(y_{jt}, z_t) = Az_t^{\alpha}(Y_j - y_{jt})^{\beta} \tag{13}$$

$$\pi(x_t, y_t) = \frac{a_y y_t + b_x}{(a_x x_t + b_x) + (a_y y_t + b_y)} \tag{14}$$

$$p_t(q_t, z_t) = B(\overline{w} - (z_t - q_t))^{\gamma} \tag{15}$$

$$C(q_{it}) = Cn^{\delta-1}q_{it}^{\delta} \tag{16}$$

with all parameters except γ assumed positive, and for diminishing marginal utility, $0 < \alpha, \beta < 1$. Equation 14 is a contest success function frequently used for lobbying games, military contests, and similar situations. It is generally attributed to Tullock [40, 41], with two different axiomization presented in Kooreman and Schoonbeek [24] and in Skaperdas [37]. The cost function definition, equation 16, has a scaling factor dependent on n. With this adjustment, the aggregate cost curve remains constant as the number of firms is changed. Thus, changes in costs are not driving results.

The contest success function used is the ratio form. As pointed out by Hirshleifer [20], this has the property that because of the high marginal gain from lobbying when total lobbying is near zero, a Nash equilibrium without some level of wasteful lobbying cannot exist. In the situation modelled here, the agent that has 'the ear of the King' likely gets there way if there is nobody else whispering. As such, the ratio form is taken to be appropriate.

Identification of equilibria was estimated through a backward induction implementation of numerical dynamic programming (See for example 2). A vector of 50 discrete values was used for each state variable, generating the value function(s) at 50 specific points. Quadratic interpolation was used to approximate value function levels between the specific points. As for the theoretical development, symmetry was imposed on the first order conditions to establish equilibrium relations. To locate the Nash equilibrium, a search was then used to identify a pair of negotiation expenditures that mutually zeroed the respective relations. The derivatives $x_t^{*\prime}$ and $y_t^{*\prime}$ were numerically estimated by perturbing the value of q_t that defined the NE. The thus calculated derivatives were part of the zero relation that defined the equilibrium q_t level. This was iterated on until the euclidean distance between value function vectors for successive periods was less than 10^{-10} or the number of iterations

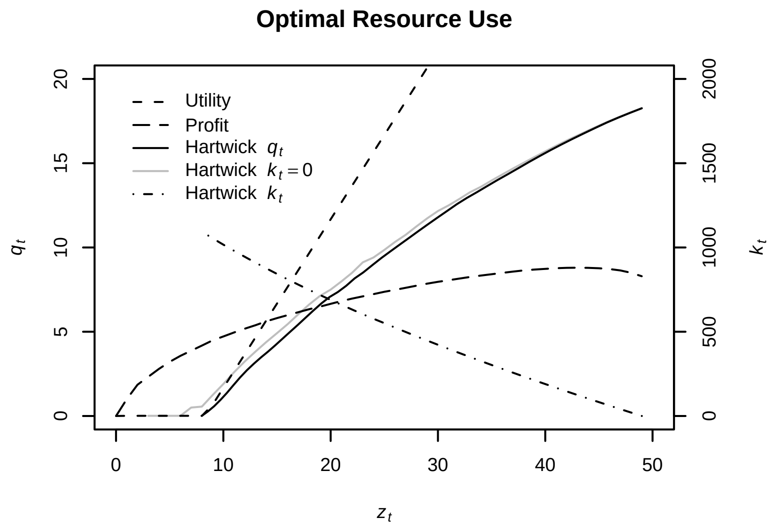

Figure 2: Optimal resource use, for utility maximization ignoring profit, profit maximization ignoring utility, and Hartwick style utility optimization, where profits are invested into a capital stock that contributes to household income. All curves except that for Hartwick $k_t = 0$ case (grey) plot on left axis. Numerical convergence problems responsible for 'bumpiness'.

exceeded 100. For the case comparisons, the convergence threshold was 10^{-10}, with a maximum number of iterations at 40. In a large majority of cases, the convergence threshold was attained. However, some cases entered stable oscillations in value function level. These were terminated after the maximum number of iterations.

The analytical development focused on a single period, examining the incentives governing the amount of development in a period, and the amount of lobbying effort. The numerical results are illustrated by linking a sequence of periods together, and examining the development paths, as well as expected total development, total lobbying, and time till development stops, as seen at the start of the game. Figure 2 shows the state dependent resource use function for three alternative optimality conditions. If firm profits are ignored and only household utility is maximized, then no development occurs if z_t is less than 8.3333, and for $z_t > 8.3333$, it is optimal to choose $q_t = z_t - 8.3333$. In contrast, if household utility is ignored and the present value of the profit of a monopoly owner maximized, all of the resource is used. However, spreading costs leads to a more gradual development path over time. Prior to any development, $z_t = \overline{w}$, where, in this case, $\overline{w} = 50$.

A third optimization is the Hartwick style case, where returns from invested profit are added to household income. When z_t is small, there is more development than with a monopolist, as that development increases community population and aggregate utility. However, development falls more rapidly hitting the z_t axis coincidentally close to the point where aggregate utility is maximized. As z_t falls, k_t increases, increasing household income, and the marginal value of the (normal) public good. Relative to the path where capital accumulation begins when $z_t = \overline{w}$, that for capital accumulation beginning later is uniformly higher, and development is halted with a smaller z_t value. Without any capital, it is worth undertaking some additional development to build it up.

Although not explored in detail, the optimality question highlights an important aspect of decentralization. Even if full ownership of the resource is provided to a community, there is no guarantee that the environment will fare better. If locals are able to capture the benefits of development, they may choose more development. Two features of the current model would lead to such an effect. First, if the benefits of development are large, relative to the local value of the public good, then greater development is likely. Second, if local income is low, making the marginal value of the income contribution of development large, then greater development is likely. If the resource in question has large aggregate value beyond the local community, decentralizing control to the local level may be worse for aggregate welfare than maintaining central control.

For comparison purposes, profit maximizing resource use and firm value are shown in figure 3. Not surprisingly, firm profit is increasing in the amount of resource remaining. The impact of changing the probability is also consistent with expectations, in that the greater the probability that the resource will be available for use next period, the more of the resource firms are willing to leave to next period. What is more interesting is the fact that the value function is not concave. Rather, when there is more than one firm, it is piecewise concave. This is a consequence of the interaction between the discrete time nature of the optimization and the prisoner's dilemma game that the firms are engaged in. Discrete time implies that actions take place at precise points in time. Here, a specific quantity of resource is used in each period, with all the remaining resource used up in some final period. One therefore does not have a smooth consumption path over time, but a sequence of distinct quantities. This is responsible for the kinks or discontinuities in the curves.

The prisoner's dilemma between imperfectly competitive firms, in this case, has the firms using more than the optimal amount of the resource, as they aim to capture it before their rival does. In panel (b), this manifests itself in the fact that the point at which the industry no longer consumes all of the resource in the first period occurs for a larger z_t the greater the number of firms. This is marked by the point where the resource use curve first has a kink. For the first segment after the kink, the remainder of the resource is consumed in the second period. However, concerns about being 'beat' to the resource in the first period are no longer drivers. As z_t is increased, a point is reached where the firms no longer use all the remaining resource in the second period. This produces a downward shift in the optimal resource use, a consequence of the drop in the slope of the value function. The quadratic interpolation used smoothed the kink in the value function that corresponds to the change in resource use, distorting the graph somewhat. In panel (a), for the $\pi = 0.0$ case, the value function did not converge, but rather entered a cyclical pattern for two of the 50 z_t levels, represented by the sawtooth just below $z_t = 40$. As the probability that development will take place next period increases, panel (a), the distance between the slope changes and between the discontinuities declines, and the size of the downward steps increases.

Figure 4 illustrates the impact of changing the effectiveness of negotiating effort (a_x and a_y) and the responsiveness of the regulator (b_x and b_y). Increasing the effectiveness corresponds to making it easier for stakeholders to engage in negotiation, as the *ceterus paribus* impact of more negotiation effort is greater. Increasing the regulator responsiveness (reducing b_x and b_y) reduces the strength of the regulator's bias. Results are all based on an initial public good level $z_0 = \overline{w}$. The graphs show the expected number of periods during which development of the resource takes place, expected public good level when development ends, and present value of industry and household expenditures on negotiation effort. All results are relative to the monopolist case with $a_x = a_y = 1$ and $b_x = b_y = 1$.

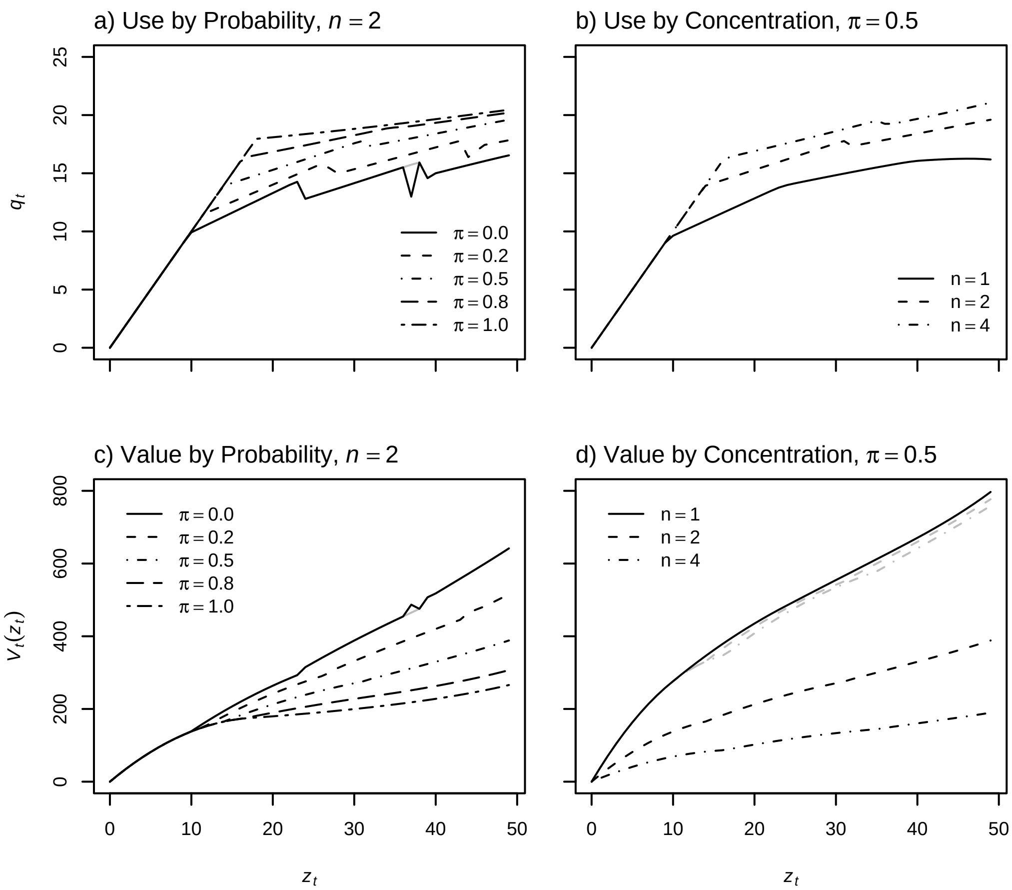

Figure 3: Resource use and firm value as functions of resource remaining unused. Panels (a) and (b) show the amount of the resource used in the current period, given the amount remaining. Panels (c) and (d) report the value of the value function, which is the present value of the optimal path from the current date forward. In panels (a) and (c), grey segment for $\pi = 1.0$ indicates alternate resource use and value function for value function cycle. In panel (d), grey lines mark total industry value, while black lines mark individual firm value.

Panels a, c, and e show the impact of changing the effectiveness of negotiation effort. Increasing the size of a_i increases the impact of additional expenditures on negotiation effort for agent type i. Increasing the effectiveness of industry lobbying increases the duration of development activity and reduces the expected final public good level, for each industry concentration level. Increasing firm numbers tends to reduce the duration of development, while increasing the expected final public good level. Two free riding effects contribute to this. First, with more firms, each seeks to free ride on the others lobbying effort. Second, the open access nature of the resource rights results in increasing development each period. Taken together, household lobbying increases more rapidly in response to faster development, and firms are unable to coordinate on counteracting it.

Negotiation efforts follow a more interesting pattern. When $n = 4$, household effort is greatest when the effectiveness levels are approximately equal. This effort is sufficient to overpower the industry lobbying effort, protecting a fairly high level of the public good. Increasing the effectiveness of the household lobbying increases the expected final public good level and reduces the Nash equilibrium negotiation efforts. Likewise, reducing household negotiation effort effectiveness reduces the NE negotiation efforts, and results in equilibria with lower final public good levels. In the most extreme case, there is almost no public good left, but firms take a long time to develop all the resource. When $n = 2$, the greatest household expenditure on lobbying takes place when households are somewhat more effective than firms in their lobbying. Otherwise, the effects are similar. When $n = 1$, there is evidence of a lobbying war. When a_y is somewhat larger than a_x then both industry and household lobbying efforts are high. However, there is not much difference in the outcome than what is observed with more than one firm.

When changes in the responsiveness of the regulator are considered, expected final public good levels are generally increasing with the number of firms, while duration tends to decline. For any particular number of firms, both duration and expected final public good level are not very responsive to changes in b_x and b_y. This is somewhat surprising, since the regulator's default (absent lobbying) probability of ending further development ranges from approximately 0.01 (0.1/10.1) to approximately 0.99 (10.0/10.1). The industry and the households respond in such a way that the bias is offset. Notice that as the bias shifts to favour one type of player - increasing b_x favours firms - negotiation effort from that type of player falls. This occurs for both player types, but is more pronounced for the households. The free riding effect on industry negotiation effort is particularly evident here, effort falls as the number of firms increases.

Efforts to increase stakeholder engagement are analogous to changing effectiveness and responsiveness. Changing responsiveness has almost no impact on expected time to development cessation, nor on expected remaining public good. Responsiveness is analogous to a regulator contribution to lobbying effort, substituting for household or firm lobbying effort and leaving the outcome unchanged. It does not change the marginal value of lobbying, and therefore does not encourage much of a change. In contrast, changing effectiveness does change the marginal impact. What stands out here is that symmetric changes in effectiveness, such as a regulator opening the process in an equal way to all stakeholders, does almost nothing to change the outcome. The outcome is only changed if engagement favours one party. However, even then it may result in a large increase in expected lobbying and a move away from the efficient level of the public good. Increasing stakeholder engagement may have little impact on outcomes, and might even make things worse. Thus, while principles of good governance may be consistent with increasing participation, it is far from certain that it will

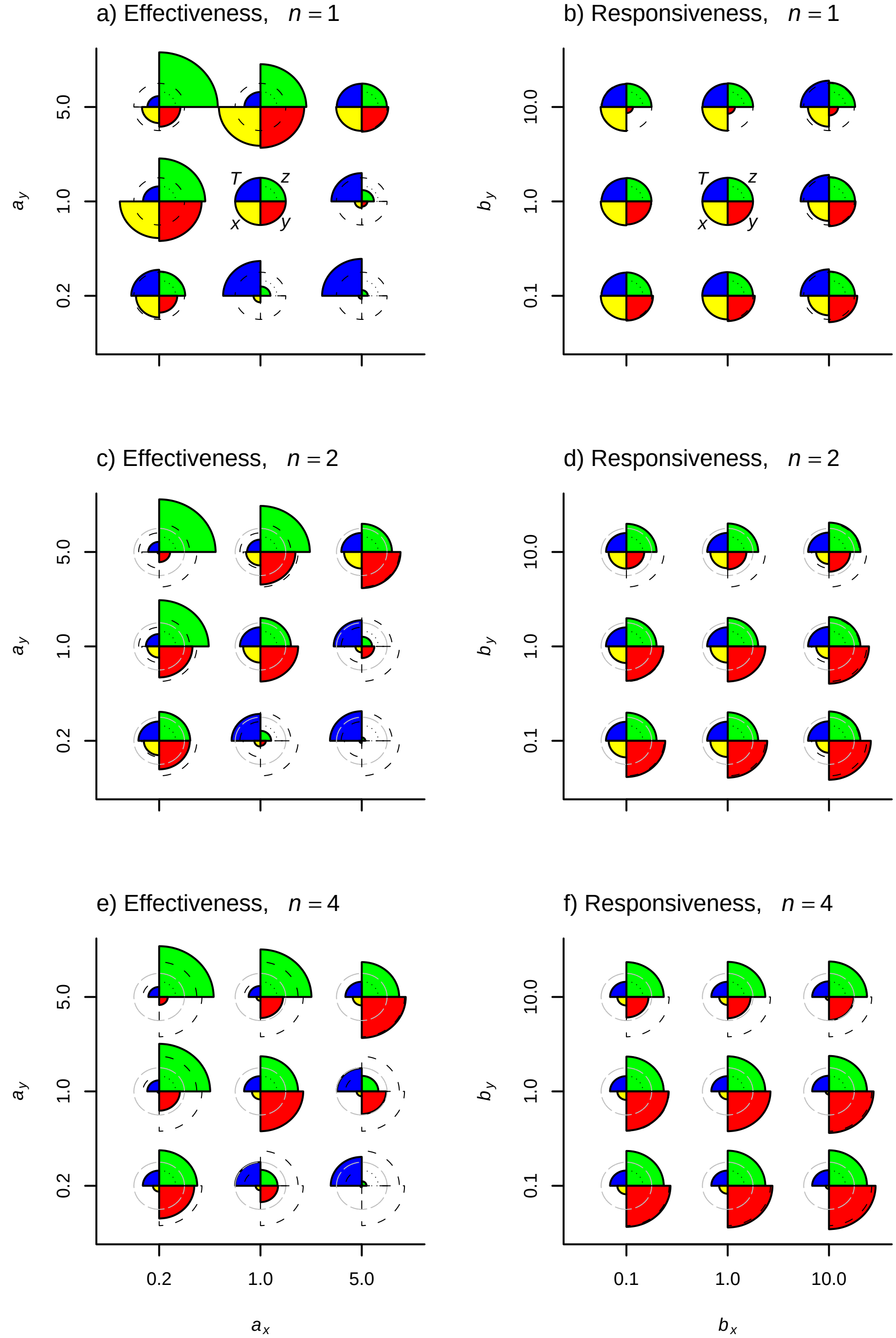

Figure 4: Expected duration (T), expected final public good level (z), expected PV of firm (x) and household (y) negotiation effort, for various expenditure effectiveness and regulator responsiveness and $z_0 = \overline{w}$. Radius of circle section measures variable relative to monopoly case with $a_x = a_y = 1$ and $b_x = b_y = 1$. Gray dashed circle in panels (c) through (f) enable reference to monopoly case. Black dashed line provides comparison to $a_x = a_y = 1$ and $b_x = b_y = 1$ case for each panel. Dotted line in NE quadrant marks optimum public good level.

improve the economic efficiency of the outcomes.

Figure 5 shows the effect of changing the utility function parameters and one demand function parameter. When changing the utility function, the elasticity parameters were restricted to satisfy $\alpha + \beta = 1$. In panels (a) through (c), the expected final public good level increases as both α and Y_i are increased, while duration falls. This is a consequence of the fact that increasing α and increasing Y_i each increase the marginal utility of the public good relative to residual income. Thus, the marginal benefit of lobbying increases, leading to an increase in this activity by the households. Increasing firm numbers reduces lobbying or negotiation effort by the firms. However, the response patterns differ for each industry concentration level. When development is monopolized, the firm responds to increased household lobbing by increasing its own lobbying effort. For the lower α and Y_i levels, this effect is also present for the oligopolistic industry. However, when $\alpha = 0.5$ and $Y_i = 50$, industry lobbying effort has fallen relative to the cases where $\alpha = 0.25$ and $Y_i = 50$ or $\alpha = 0.5$ and $Y_i = 10$. For all cases in panel (b), household lobbying effort is greater than in panel (a). Free riding by the firms increases the marginal productivity of household lobbying effort, which for large α and Y_i is successful in further driving down industry lobbying. Although dominated by the free riding effect, in panel (c) industry lobbying again falls for the highest α and Y_i levels. For low α and Y_i levels, households increase lobbying, relative to the $n = 2$ case. However, the ability of household lobbying to drive down industry lobbying is strong enough when α and Y_i are large that household lobbying actually falls relative to the $n = 2$ case. When the public good is valuable enough to the households, and households have enough income, firms essentially capitulate in the lobbying game, which then reduces the household's need to lobby. Not surprisingly, wealthy neighbourhoods get their way at lower cost than less wealthy neighbourhoods.

An interaction between the free riding effect on lobbying and the free riding effect on development is also evident in panel (d). When γ is small, increasing n reduces duration and increases the final public good level. This is driven by free riding on lobbying effort. Reduced lobbying by the industry is matched by increased lobbying from households, leading to a shift in continuation probabilities favouring the households. Thus, the expected final public good level is here increasing in the number of firms. When $\gamma = -0.5$, firms essentially give up on any development after the first period. Consequently, they do not invest in negotiation effort, making it unnecessary for households to invest much. Reducing firm concentration now reduces the final public good level, as with greater concentration, firms reduce first period development to increase rents captured.

4 Discussion

Most allocation decisions around finite resources are not made by an omniscient regulator. In general, the regulator is influenced by the affected parties, the stakeholders, in some way. At one extreme, stakeholders may directly or indirectly try to bribe the regulator. The unfavourable connotation to the term lobbying seems to reflect this somewhat shady side of trying to influence a regulator's decision. At present, in response to a widely held disillusionment with the conventional process, many are encouraging stakeholders to directly engage each other. This process may appear different, but fundamentally it still requires stakeholders to expend resources in an effort to influence the resource management decision in their favour. Now, rather than directly buying favours, they have to show that they are cooperating with other stakeholders in resolving the resource sharing conflict.

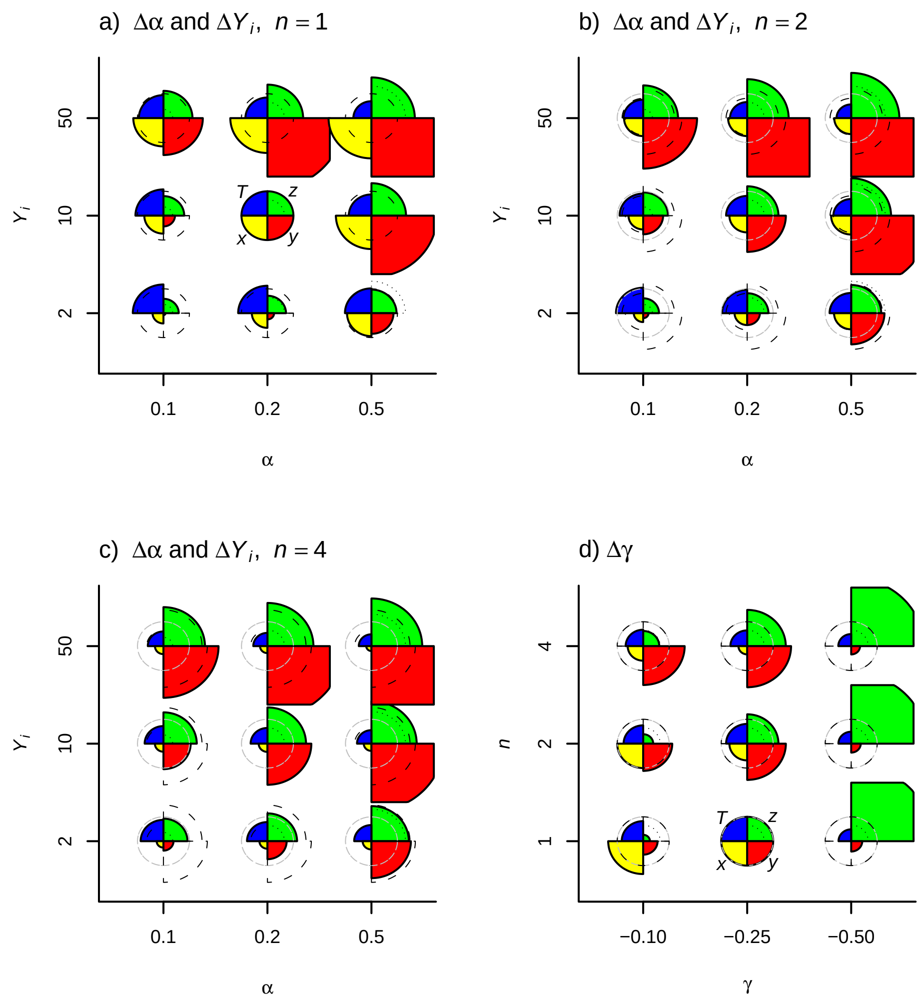

Figure 5: Variations in utility function parameters and demand elasticity. For panels (a) to (c), α and Y_i respectively measure utility elasticity of the public good and residual income. In panel (d), γ measures the price elasticity of demand. Quarter circles have been clipped to prevent overlap with adjacent graph objects.

Herein we have considered a simple model of a resource management problem, where the management decision consists of halting all further development of the resource. The resource is both finite and durable, consistent with land or rights to an annual allocation of water. Both pro- and anti-development lobbies attempt to influence the decision of a regulator with final authority over whether further development occurs. Four outcomes are identified, cases with limited lobbying, those where the pro-development lobby overpowers the anti-development lobby, the converse, and a lobbying war. This latter case is perhaps the most disturbing, as it suggests that lobbying, whether as traditionally envisioned, or now as 'stakeholder engagement' may have little impact on the final outcome. As such, lobbying is simply a waste of resources, engaged in because participants are involved in a prisoner's dilemma. In particular, if lobbying is made easier for stakeholders to engage in by government facilitating meetings and other forms of interactions, losses may be exacerbated. In the first case, government spends money to lower the cost of involvement in the process. The reduction in the marginal cost of influencing the regulator induces stakeholders to spend more on this activity. In the end, the outcome may be no different, but overall costs have increased.

These results also suggest that compensation payments for habitat protection may be sensitive to industry structure. The presence or absence of compensation has been shown to affect the rate of development, with uncompensated takings hastening development and full compensation slowing it [5, 21, 35]. Without compensation, there may even be an incentive to destroy the public good value [22]. Although compensation is not the focus of our model, our results do speak to this issue. In particular, if the purpose of compensation is to pay firms the present value of the asset being taken, our results show that industry structure can play an important role in determining the size of the present value - the less concentrated the industry, the lower the payment. Thus, although the monopolist may be the friend of the conservationist, in terms of the rate of development, the monopolist does not let the conservationist off cheaply if development is to be halted.

The inefficiencies highlighted here are a consequence of the lack of clear property rights. In the case of land, owners do not have an exclusive right to decide how to use their property. The right to a particular use - development - must be acted upon before the regulator decides that enough such rights have been acted on. With land, such 'takings' themselves typically lead to a set of legal battles about whether or not the property owner did own a development right - requiring compensation - or not. For water, in contrast, rights are typically usufructory, and only allocated when a need is demonstrated. Thus, water rights are not owned until development that can use it has taken place. When property rights to water are vested with the user, then arrangements such as leasing or purchase can protect public values from instream flows. In both cases, the key property right is essentially open access. Clarity of the legal right to develop property or to access water, independent of when those uses occur, would reduce the incentive problems analyzed in this paper.

The role of firm size also bears some reflection. As modelled, there are no economies of scale related to development costs captured by the firms. This is likely a reasonable reflection of the construction industry, where the trades (electricians, plumbers, carpenters) are generally characterized by a large number of small firms. The benefits of size in the model come from a reduction in free riding incentives both in lobbying and in the final market. The current trend towards relatively large developments, with multiple year development plans, may be a means of pre-empting the lobbying process. Firms are able to secure their development rights before the occupants arrive, who may desire less development. An interesting empirical analysis would be to search for a relationship between development project size (units, area, or years to build) and per unit public space. If larger projects are pre-empting the lobbying process, then public space should be smaller.

5 Conclusion

A stylized land development industry which consumes a public good generating resource (open space, surface water) is modelled interacting with community occupants in a lobbying game. Households and the industry are lobbying to affect whether further development is allowed. Lobbying effort invested depends on the relative power of the agents, with some combinations resulting in a lobbying war. Increasing the effectiveness of lobbying, akin to reducing the marginal cost of participation in the planning process, tends to have little impact on the outcome when both interests are affected symmetrically. This suggests that the currently popular stakeholder engagement efforts may do little to change outcomes. If these initiatives are costly to implement, and if they encourage greater lobbying effort by the stakeholders, then they are wasteful. If it is known which affected party is disproportionately powerless, then the efficiency of the outcome can be improved by equalizing the power balance. However, in so doing, there is the risk that a wasteful lobbying war can develop. Further, such shifting of the power balance presupposes that the regulator knows in which direction the efficient amount of development is, a possible problem. The results of this analysis also suggest that trends towards larger development projects and concentrated development firms may in part be a response to the threat of lobbying.

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