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# COMPETITION AND COMMON PROPERTY

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ABSTRACT The following paper is a discussion of the dynamics of competition in the presence of common-property resources. We discuss three classic models: Hotelling's ice-cream sellers on the beach, the Prisoner's Dilemma, and Hardin's Tragedy of the Commons. All are expounded in a game-theory framework, which emphasises the strategic interaction inherent in each, as well as their differences.

## 1. On the Beach . . .

### *1.1 A Hot Afternoon*

CONSIDER a stretch of beach with eighty sunbathers evenly distributed along it. There are two ice-cream sellers: you are one. As far as the sunbathers are concerned, the best positions for you and the other ice-cream seller are *A* and *B* in the figure, the quarter and three-quarters positions along the beach, since these minimize the average distance any sunbather has to walk for an ice-cream, one-eighth of the beach. Suppose you are the left-hand seller starting at position *A*, and that the other seller starts at position *B* in the figure. You now sell to the region *LAC*, and the other seller sells to the region *CBR*.

| | | | | |
|---|---|---|---|---|
| \| | \| | \| | \| | \| |
| *L* | *A* | *C* | *B* | *R* |

Since the sunbathers are evenly distributed between *L* and *R*, and are otherwise identical, you and the other seller each expect to sell an equal number, forty ice-creams.

But now you realise that by moving a little to the right you can increase your expected sales by capturing some of the other seller's market, those sunbathers just to the right of *C*, who now find it more convenient (shorter) to walk to the left for their ice-creams than to the right, as previously. At the same time, of course, the average distance your customers have to walk increases, since you are farther to the right. But the other seller will not be content to lose his market: he will realise that by moving a little to the left he can recapture those of his previous customers to the right of *C* who now find it more convenient to buy from you. Indeed, he might well move closer to *C* than you are, in order to capture some of the market on the left half of the beach.

We can imagine this shuffling continuing until each seller is at the centre of the beach, with equal sales. If we ignore the possibility of sunbathers near *L* and *R* deciding that the extra distance to the ice-cream is excessive, neither seller will have gained or lost any new customers. We speak of this situation as a "two-person, zero-sum game," since the total market is unchanged: there is direct conflict, with one seller's gain being the other seller's loss. It is possible to speak of two alternatives facing each seller: move to the centre (M) or remain at *A* or *B* (NM). We can then write two "payoff matrices," showing values to each seller of the four combinations of strategies:

The values shown in Table 1 are your sales, given the actions of you and the other seller: if neither seller moves, you have half the market (from *L* to *C*); this is also the case if both sellers move (to the centre), assuming that no customers are discouraged by the doubling of the average distance to the ice-cream; if you move to the centre while the other seller remains at *B*, then your sales increase (in the limit to fifty with perfect knowledge, no customer loyalty, and no customer discouragement); if you remain at *A* while the other seller moves to the centre,

| | | *The other seller* M | NM |
|---|---|---|---|
| *You* | M | 40 | 50 |
| | NM | 30 | 40 |

**TABLE 1.  Your payoff matrix**

then sales fall (in the limit to thirty).

The sales of the other seller behave in symmetrical fashion, as shown in Table 2.  In the case we have assumed, that of a zero-sum game, in which there is no reduction in the total market, the sum of the sales is always eighty, the total market.

| | | *The other seller* M | NM |
|---|---|---|---|
| *You* | M | 40 | 30 |
| | NM | 50 | 40 |

**TABLE 2.  Payoff matrix of the other seller**

Consider your best strategies.  If the other seller moves, then, from the first payoff matrix, your best strategy is to move too, to maintain your sales.  If the other seller does not move, then your best strategy is to move, to capture some of the right-hand market.  In either case, you should move:  for you, moving dominates not moving.  This is seen to be true for the other seller too.  So each seller moves, and both end up at the centre with equal market shares.*

But although neither seller gains an advantage so long as each behaves identically, and although in this case each seller is indifferent between moving to the centre of the beach and remaining at his beginning position on the beach, the sun-bathers do have an interest in the outcome of the competition between the two sellers.  In the initial situation of the sellers at *A* and *B* the average distance for the sun-bathers to walk to buy an ice-cream is one-eighth of the beach.  But after the two sellers have vied for larger market shares and, as we have seen, have ended up at the centre of the beach, the average distance has doubled to one-quarter of the beach.

* Note that a physical model of this behaviour is easily demonstrated.  Balance a ruler on two fingers, one at the 3" mark and the other at the 9" mark (of a foot rule).  Slowly, bring your fingers together.  Think of the position of each finger on the ruler as the position of the corresponding ice-cream seller on the beach.  As with the ice-cream sellers, your fingers end up together at the 6" centre mark.

The point of this simple example is not that we now have a realistic model of ice-cream selling and buying on the beaches of Australia. We do not have such a model: the assumptions are too restrictive, in particular the assumption implicitly made that no other sellers will appear on the beach. Instead, we have an example which disproves the general proposition that competition will *always* improve the social well-being. In this case, had there been no competition between sellers, they would have remained at *A* and *B*, and buyers on average would have had a shorter distance to walk than when both sellers had competed and so had ended up together at *C*.

### *1.2 Lazy Bathers*

What if the extra distance to the centre meant the difference between buying and not buying for some sunbathers at the ends of the beach? That is, what if the demand for ice-creams were not completely inelastic? Then the total market would contract as the sellers moved together. For instance, what if no-one on the beach would walk further than a quarter of the way along the beach for an ice-cream? It is easily demonstrated that the payoff matrix changes. (See Table 3, in which entry *x*,*y* means that you sell *x* ice-creams and the other seller sells *y* ice-creams.)

| | | *The other seller* M | *The other seller* NM |
|---|---|---|---|
| *You* | M | 20,20 | 30,30 |
| *You* | NM | 30,30 | 40,40 |

**TABLE 3. The combined payoff matrix with lazy bathers**

We see that the game is a "non-zero-sum game:" only if neither seller moves does the total market not contract; if one moves to the centre, the total market falls to sixty; if both move to the centre, the total market falls to forty.

Consider your best strategy as the left-hand seller: if the other seller moves, your market is thirty if you do not move and twenty if you move; if the other seller does not move, your market is forty if you do not move and thirty if you move. Whether or not the other seller moves, you should stay put: your best strategy is NM, do not move. Moreover, you have an incentive (of ten sales) to dissuade the other seller from moving. But, since the other seller's payoff matrix is identical from his point of view, he will similarly stay put.

If the two sellers were initially at *C*, the centre of the beach, then it would reward them to move out to the quarter and three-quarters points, *A* and *B*, and they would do so. In this case competition between the sellers *would* benefit everyone—sellers (each of whom would sell more ice-creams) and bathers (some of whom would now prefer to walk the (shorter) distance to buy an ice-cream than to stay put). But whether or not competition benefits everyone depends upon the particular parameters of the situation: in this case the strength of the bathers' demand for ice-creams.

If the maximum distance anyone would walk for ice-cream were the fraction $x$ of the beach (where meaningful $x$ is less than half), it is readily found that your payoff matrix can be written as:

| | | *The other seller* M | NM |
|---|---|---|---|
| *You* | M | $80x$ | $80x+10$ |
| | NM | 30 | 40 |

**TABLE 4. Your payoff matrix, $1/4 \leq x \leq 1/2$**

Then if $x$ is less than three-eighths, not moving will dominate, while if $x$ is greater than three-eighths, moving will dominate. As the distance customers are willing to walk falls further, your payoff matrix changes. (See Table 5).

| | | *The other seller* M | NM |
|---|---|---|---|
| *You* | M | $80x$ | $80x+10$ |
| | NM | $80x+10$ | $160x$ |

**TABLE 5. Your payoff matrix, $1/8 \leq x \leq 1/4$**

From comparison of Tables 4 and 5 we see that except for $x$ between three-eighths and a half, not moving is at least as good as moving, whether or not the other seller moves. This is demonstrated in Figures 1*a* and 1*b*. The first shows your sales if the other seller moves, the second shows your sales if the other seller does not move, both plotted against the maximum distance $x$ that sunbathers will walk along the beach to buy ice-creams, for the two strategies of your moving or not moving.

### *1.3 Ignorant Sellers*

Consider the situation when the other seller knows that the maximum distance the sunbathers will come for their ice-creams is a quarter ($x = ¼$) while you believe that they will come at least half the length of the beach ($x > ½$). If the other seller thinks that you know the true, lazy nature of the sunbathers, he will expect you not to move, and will himself stay put, expecting sales of forty, as we see from Table 4 and Figure 1*b*. But, to his dismay, you move, whereupon each seller will have sales of thirty. The other seller may see your actions as (false) evidence that his belief of the customers' laziness was wrong, that the sunbathers would go at least half the beach to buy, and that, as in Table 2, you were selling fifty ice-creams. If the other seller then moves, he will realize that he was correct to begin with, and, as seen in Table 4 and Figure 1, each seller has his original market halved, from

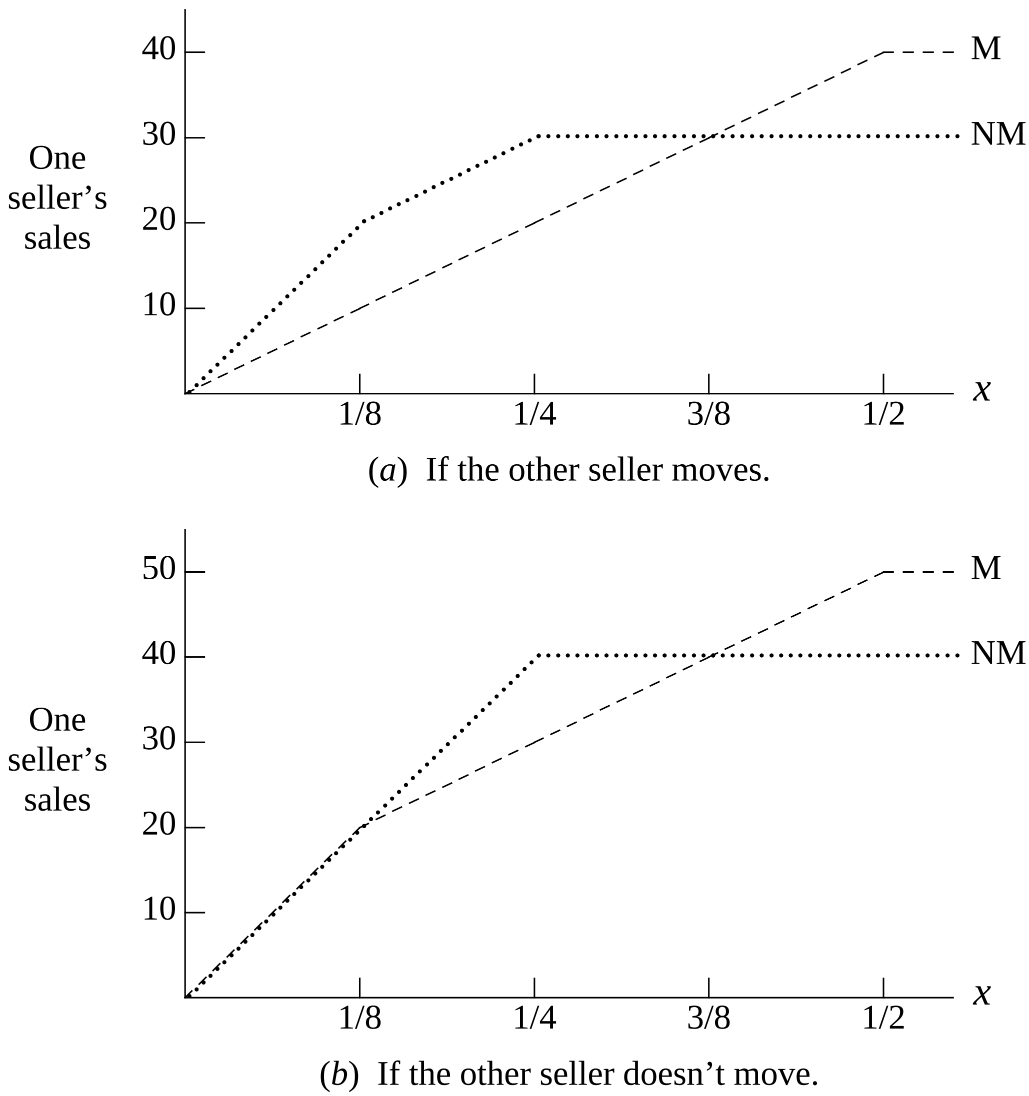


**FIGURE 1: One seller's sales against the maximum distance *x* customers will walk.**

forty to twenty.

In this non-zero-sum game there exists the possibility of mutual gain or loss. In the case above of $x = ¼$, each loses if both move. It is to the advantage of each that both know the true value of $x$. In this case, if both know the true value of $x$ (whatever it is), they will each choose the strategy which leads to the best outcome for them both and for the sunbathers, too, given the assumed barrier to entry of more sellers. This is an example of competition leading to the best *social* outcome as each seller seeks to maximize his sales independently. For example, in Table 3 neither seller will move (NM), retaining sales of forty each, and satisfying all the sunbathers. Indeed, in that case ($x = ¼$), neither seller can move without reducing both sellers' sales and leaving some sunbathers too far from the ice-cream.

An example in the real world of the behaviour of the two ice-cream sellers can be found in the Australian "two-airline agreement" between Australian

Airlines, Ansett, and the Federal Government: the reader is invited to consider whether the rationalisation committee is necessary to ensure parallel scheduling of flight times, or whether this would occur (or tend to occur) as a natural consequence of competition between the two companies.

We can think of the line of the beach as analogous to any one-dimensional characteristic, and the seller's position on the beach as the quantity of the characteristic. That is, instead of sellers of an identical good separated geographically we might have considered two competing cider merchants side-by-side, one selling a sweeter liquid than the other. If the consumers of cider be thought of as varying by infinitesimal degrees in the sourness they desire, we have much the same situation as with the ice-cream sellers. The measure of sourness now replaces distance. We might conclude that competing sellers tend to become too much alike.

In this light, could the convergence of fashions be seen as an outcome of competition between fashion companies for customers? Could the similarity of commercial television programming be explained by a similar process? If we concluded that it could, and if we saw diversity of programming as a desirable goal, then perhaps we would see ownership of two television channels by one company as a solution, leading to differentiation of the channels' programmes in order to appeal to a larger share of the viewing audience. (A different strategy might be for the company to let its channels compete directly, with similar programmes, in order to increase the total viewing audience.)

We shall now examine a two-person, non-zero-sum game in which non-coöperation leads to both players' being worse off than with coöperation, in which the non-coöperation of competition does not work.

**Reference:** H. Hotelling, "Stability in competition," *Economic Journal, 29:* 41–57, 1929.

## 2. The Prisoner's Dilemma

IMAGINE you want to buy a fur coat. You arrange a mutually agreeable trade with the only dealer of fur coats known to you. You are satisfied with the fur coat you will be buying, and the dealer is satisfied with the amount of money he will be getting in exchange. But for some reason the exchange must take place in secret. Each of you agrees to leave a bag at a designated place in the bush and to pick up the other's bag at the other's designated place. Suppose it is clear to both of you that you will never meet or have further dealings with each other again.

Clearly, there is something for each of you to fear: that the other one will leave an empty bag. Obviously, if you both leave full bags as agreed, then you will both be satisfied, but, equally obviously, it is even more satisfying to get something for nothing. So you are tempted to leave an empty bag. You can even reason through with seeming rigour: "If the dealer brings a full bag, then I'll be better off having left an empty bag, because I'll have got all I wanted and given nothing away. If the dealer brings an empty bag, then I'll be better off having left an empty bag, because I won't have been cheated—I'll have gained nothing but lost nothing, either." Thus, it seems that no matter what the dealer chooses to do you're better off leaving an empty bag.

The dealer faces the same incentives and comes to the same conclusion that it is better to leave an empty bag. And so each of you, with your apparently rigorous logic, leaves an empty bag and goes away empty-handed. But this is sad, because had you both coöperated as agreed then you could each have been better off. Does logic prevent coöperation? This is the issue presented by the Prisoner's Dilemma.

In the original formulation of the Prisoner's Dilemma there are two prisoners, each of whom can either confess or not confess to a particular crime. There is circumstantial evidence of their guilt, but the authorities would prefer at least one confession. If both keep mum, both will serve a short sentence; and if both confess, each faces a medium prison sentence. If, however, one confesses and the other does not, the one who informs will be set free, while the one who keeps mum faces the maximum prison term. The prisoners, then, face a dilemma. Imagine you are one of the prisoners. Even if you could both get together and discuss your pleas, and even if you both realised that, acting together, you would both be better off if each refused to confess, you each realise that there is a possibility that the other by informing will double-cross you, not only leaving you to languish in prison for a long time, but going scot-free. You therefore experience a strong incentive to confess, thereby avoiding the maximum prison sentence whatever the other prisoner does. The other prisoner faces the same incentive. In this simple once-off version, both confess, and so each of you is worse off than if you had coöperated by not confessing.

We can quantify these examples by building a payoff matrix presenting point values of the various alternatives.

| | | *Other Player* | |
|---|---|---|---|
| | | C | D |
| *You* | C | 4,4 | 0,5 |
| | D | 5,0 | 2,2 |

**TABLE 6. Payoff matrix for the Prisoner's Dilemma**

In the Table *x*,*y* means that your payoff is *x* units and the other player's is *y* units. C corresponds to coöperating (leaving a full bag, or keeping mum), D to defecting (leaving an empty bag, or informing). The Reward for mutual coöperation is 4 (trading the fur coat, or both serving a short sentence); the Punishment for mutual defection is 2 (both leaving empty-handed, or both serving a moderate prison term); the Temptation of cheating is 5 (something for nothing, or freedom); and the Sucker's payoff of being cheated is 0 (nothing in return, or the maximum prison term).

From your point of view it is apparent that the strategy of defecting (leaving an empty bag, or informing) dominates that of coöperating (leaving a full bag, keeping mum) in that, whatever the other player does, you are better off defecting: if the other player coöperates, you can increase your payoff from 4 to 5 by defecting, while if the other player defects, you can increase your payoff from 0 to 2 by defecting. By this reasoning, you defect. The same considerations apply to the other player, who also defects, so you both defect and receive a payoff of 2 each. But from Table 6 it is clear that you would *both* be better off if neither defected, since you would both then obtain a payoff of 4 each. If each could rely on the other or somehow convince the other that he would not defect, you would both be better off: a case of increasing the efficiency of the system through *trust.* The need for coördination and communication is apparent since in this example individually rational behaviour can lead to inferior outcomes for all individuals, and competition does not translate individual self-interest into the common good. (Query: why does an effective threat require *two-way* communication, or does it?)

These examples are not isolated; there are many important social, economic, and political situations in which such a paradox appears. One economic example is the choice between free trade and protectionism: all countries together are better off with free trade, but a single country can, in a general situation of free trade, improve its own position by a tariff. This may explain the description of the collapse of free trade in the slump of the nineteen-thirties as a "beggar-my-neighbour" policy. At the individual level, there are, of course, customs and mores against cheating (the socialization of conscience, for example), but every so often we learn of a "con" man or woman who has been able to cheat many people, to his or her fraudulent gain. (It may be that, apart from that of holding stocks of goods, one of the rôles of middle-men is to facilitate trading. Organized markets, such as stock exchanges, with their reputations to protect may also achieve the same result.)

A political example is that of mutual arms reductions between two super powers, say the U.S.A. and the USSR: with today's stockpiles of nuclear weapons, the "game" is only likely to be played once, since either one or the other will win decisively, or both will lose. Each sees that it is in their common interest to agree on reductions, but neither can trust the other not to double cross. Each then experiences an incentive not to reduce, but perhaps even to build up their arms, increasing the likelihood of the worst case for both, of both being annihilated (and the rest of us besides). (An interesting historical example of coördination between adversaries to reduce the joint cost is that of the decision of the contesting Japanese principalities in 1637 to stop using guns, recently introduced by Europeans: for over two hundred years they stopped "progress" and reverted to the sword in fighting among themselves.)

In practice, interactions between people or organizations are rarely once-off. In the repeated situation, the incentive to defect is not as strong, although the payoffs for each encounter remain unchanged. Robert Axelrod has studied various strategies playing against each other in a repeated Prisoner's Dilemma game. He has found that the strategy of Tit for Tat ("I start off coöperating, and then do to you what you did to me last time") is extremely robust.

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## 3. The Tragedy of the Commons

### *3.1 Aways Overgrazing*

CONSIDER a pasture open to all. Each shepherd will try to keep as many sheep as possible on the commons, that is, each shepherd seeks to maximize his gain: he asks what the additional net benefit to him is of adding one more animal to his flock. There is a gain, which is partly offset by a loss.

The gain is a function of the increase in the flock by one animal. Since the shepherd receives all the proceeds from the sale of the additional animal, the gain can be represented as plus one. The loss is created by the additional over-grazing by one more animal. But since the effects of over-grazing are shared by all the shepherds, the loss for any particular decision-making shepherd is only a fraction of minus one.

Comparing his gains and losses, the shepherd concludes that positive net benefits remain (taking losses into account), and concludes that the only sensible course for him to follow is to add another animal to his flock—and another, and another . . . But this decision is reached by every rational shepherd sharing a commons. And there's the tragedy. Each man is locked into a system that compels him to increase his flock without limit.

There are two assumptions implicit in this discussion. First, each shepherd acts essentially for his own good without regard for the good of the others: there is no community. Second, each shepherd when faced with a chance to increase profits is under great pressure to do so. We shall introduce a third assumption in order to describe the tragedy of the commons as a non-zero-sum, two-person game:

we shall assume that the loss in values of each sheep kept on the over-grazed pasture increases in straight proportion to the number of sheep introduced beyond grazing capacity.

Let the number of shepherds be denoted by $m$, the average number of sheep belonging to each of them at the limit of grazing capacity of the commons by $s$, and the total of the flock at this limit by $N = ms$. If the value of each sheep with no over-grazing is taken as unity, and if the loss in value of each sheep due to one over-grazing animal is $b$, and if $x$ is the number of sheep introduced beyond grazing capacity, then the value of each sheep with over-grazing becomes $(1–bx)$, and the total value of the flock $(N+x)(1–bx)$. Over-grazing is said to occur if the introduction of one or more additional sheep leads to a fall in the total value of the flock, that is, if $N$ is greater than $(N+x)(1–bx)$, which will be so if $b > 1/N$.

For our purposes we can think of the tragedy of the commons as a non-zero-sum, two-person game. The two players are (1) one of the shepherds, known as "Our Individual Shepherd" (OIS), and (2) "All the Other Shepherds" (AOS). Each player has one move to make, and he has two choices: Our Individual Shepherd, those of adding or not one sheep; and All the Other Shepherds, those of adding one sheep each, or of not adding any sheep. (We can show that whether All the Other Shepherds act together or not does not affect our result).

The payoff matrix of Our Individual Shepherd is shown in Table 7. The upper left-hand element of this matrix is the value of the flock of Our Individual Shepherd after all have added one sheep to their flocks. The size of the flock of Our Individual Shepherd is $(s+1)$, if we assume that he has a flock of average size $s$ to begin with, and the value of each sheep in his enlarged flock is $(1–bm)$, since there are $m$ additional sheep, one for each shepherd. The other elements are obtained similarly.

| | | *All Other Shepherds* | |
|---|---|---|---|
| | | Add | Do Not Add |
| *Our Individual Shepherd* | Adds | $(s+1)(1–bm)$ | $(s+1)(1–b)$ |
| | Does Not Add | $s\,[1–b\,(m–1)]$ | $s$ |

**TABLE 7. Payoff matrix of Our Individual Shepherd**

We can assume numerical values. For example, there are seventeen shepherds ($m$ = 17), each with twenty sheep ($s$ = 20), and thus the total flock $N$ is 340 ($N = 17\times20$). The loss in value of each sheep due to one over-grazing animal is one percent ($b$ = 0.01). The payoff matrix of Our Individual Shepherd becomes Table 8.

It is obvious that if All the Other Shepherds do not add any sheep (right-hand column of the payoff matrix), it is worthwhile for Our Individual Shepherd to add a sheep so long as $b < 1/(s+1)$, that is, so long as the loss due to the introduction of an additional sheep is not "too" large; in our example we need $b$ less than 1/21=4.76%. If All the Other Shepherds each add a sheep (left-hand

| | | *All Other Shepherds* | |
|---|---|---|---|
| | | Add | Do Not Add |
| *Our Individual* | Adds | 17.43 | 20.79 |
| *Shepherd* | Does Not Add | 16.8 | 20 |

**TABLE 8. Particular payoff matrix of Our Individual Shepherd**

column of the payoff matrix), it is still worthwhile for Our Individual Shepherd to add a sheep too, because his loss is thereby decreased. Thus, whatever the action of All the Other Shepherds, Our Individual Shepherd will always have an incentive to add a sheep to his flock. Obviously, each of the shepherds will put himself in the position of Our Individual Shepherd and come to the same conclusion: whatever the others do, it is worthwhile for himself to add a sheep to his flock.

This is the "tragedy of the commons": each individual shepherd who wishes to optimise his strategy will add a sheep to his flock, and this leads necessarily to disaster for the community as a whole. The "invisible hand" of independent competition leads, in this case of a resource in common, not to the common good but to its opposite.

We see that Our Individual Shepherd can make a gain by adding a sheep to his flock only if All the Other Shepherds do not do so. If they also add to their flocks Our Individual Shepherd cannot make a gain, he can only decrease his loss by adding to his flock. It would therefore be to the advantage of the individual shepherd to convince all the others not to add any sheep to their flocks, and to do so himself alone. By considering the payoff matrix of All the Other Shepherds, Tables 9 and 10, we see that, whatever the move of Our Individual Shepherd, all the others are better off if they do not add to their flocks.

From Table 10, we see that if Our Individual Shepherd does not add to his flock (lower row) then All the Other Shepherds will sustain a loss if they add to their flocks, while not adding will leave the value of the flocks unchanged. When Our Individual Shepherd does add to his flock (upper row), the value of the flocks of All the Other Shepherds falls, but they can reduce their loss by not adding to their flocks.

Since, from Table 8, we saw that it was to Our Individual Shepherd's advantage to add a sheep to his flock whether all the others together added zero or $m-1$ sheep, it is obvious that this is also true for any intermediate number of sheep, and we can disregard the $m-2$ other moves which All the Other Shepherds, taken as a group, can in fact choose.

From Table 8 we see that Our Individual Shepherd obtains a larger gain from adding a sheep to his flock if All the Other Shepherds do not add to their flocks (0.79) than if they do (0.63), although this is not a very large incentive for him to convince them not to add to their flocks—from Table 10 they have reason enough not to, so long as they act as a group.

| | | *All Other Shepherds* | |
|---|---|---|---|
| | | Add | Do Not Add |
| *Our Individual* | Adds | $(m-1)(s+1)(1-bm)$ | $(m-1)s(1-b)$ |
| *Shepherd* | Does Not Add | $(m-1)(s+1)[1-b(b-m-1)]$ | $(m-1)s$ |

**TABLE 9. Payoff matrix of All the Other Shepherds**

| | | *All Other Shepherds* | |
|---|---|---|---|
| | | Add | Do Not Add |
| *Our Individual* | Adds | 278.88 | 316.8 |
| *Shepherd* | Does Not Add | 282.24 | 320 |

**TABLE 10. Particular payoff matrix of All the Other Shepherds**

Thus, so long as each shepherd selects the strategy most advantageous to himself as an individual he will add a sheep to his flock, to the overall loss of the group of shepherds as a whole. As long as the community of shepherds is unable or unwilling to convince its members that it is worthwhile to act in coöperation, or to force them to do so, competition in stocking more sheep will lead to everyone's losing.

### *3.2 And the Rest*

Other situations similar to the commons are (1) fisheries, where each fisherman has no incentive to stop fishing so long as others are still fishing; (2) the common pool problem of oil wells, where any producer who decides to postpone production will find he has an empty well after the other producers in the common pool have drained it; (3) traffic congestion, where each driver has no incentive to take a slower route although his entry on to the freeway in times of congestion will slow everyone else down—drivers will continue to enter the freeway until the expected duration of the trip using the freeway is no shorter than that for the alternative routes; and (4) pollution, where there is no incentive for one polluter to stop polluting (that is, consuming clean air/water) so long as others continue to do so and are able to hold down their production costs by doing so, since the cost of the polluted air or water is borne by a large number of people, but the benefits accrue to the polluter.

A topical example is (5) that of a large number of sellers and a single buyer: the buyer will play the sellers off against each other to get a lower price, and it is in the collective interest of the sellers to collude to keep the price up, especially when the good being traded is durable. An example of this is the sales of Australian minerals to Japan: under Australian Government export guidelines the interests of Australians are better served by controlled competition between sellers (mineral companies and/or states) than by unrestricted competition leading to lower prices, given that the demand is reasonably inelastic at realistic prices.

A related situation is that of "public goods" and the "free rider:" for certain products like national defence, some kinds of education, and traffic control, benefits spill over to other parties in such a way as to undercut the incentive of any one buyer to buy. A lighthouse will shine for anyone at sea. But since ordinarily anyone can use its services without paying, everyone wants to be a free rider. For such "public goods," authority is required to impose a charge on users; otherwise the goods will not be produced. This is a case of social organization which exchange in markets cannot accomplish and for which alternative methods of provision must be sought, if they exist.

Conclusion: these models are useful to demonstrate examples counter to the proposition that "competition is always for the best:" it usually is, but not always. The models, although by no means realistic, teach us that as managers we should not fall into the trap of substituting rhetoric for thought, ideology for imagination.

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