KILLING THE GOOSE

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In certain situations, "industrial self-regulation" is not merely questionable, it is farcical.

THE TRAGEDY OF THE COMMONS consists of the irrevocable working out of the following situation as quoted in a recent paper by Garrett Hardin.[1] The formulation given here dates from 1833.

> The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy.

Each herdsman seeks to maximize his gain. More or less consciously, he asks, "What is the benefit to me of adding one more animal to my herd?" There is a benefit, which is offset by a loss.

The benefit is a function of the increase in the herd by one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the benefit can be represented as +1.

The loss is created by the additional overgrazing by one more animal. Since, however, the effects of overgrazing are shared by all the herdsmen, the loss for any particular decision-making herdsman is only a fraction of -1.

Comparing benefits and losses, the herdsman concludes that positive gains remain even after losses are taken into account, and concludes:

> the only sensible course for him to pursue is to add another animal to this herd. And another; and another ... But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit - in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all.

There are three important assumptions in the above description of the tragedy of the commons: One, each herdsman (entrepreneur) acts essentially alone for his own good without regard for the good of the others; there is no community. Two, each herdsman (entrepreneur) when faced with a chance to increase profits is under great pressure to do so and will eventually act in accordance with that pressure. Three, the ruining of the commons causes ruin for the entrepreneurs.

The first two assumptions fit many areas of the business world rather well. However, there are many situations in the business world where the third assumption might seem to apply, but where in fact ruining the commons does not bring ruin to the entrepreneurs. The last line of the quoted tragedy of the commons is not strictly correct. lt should read ". . . brings death to the commons." If death to the commons brings ruin to the entrepreneurs then we have the tragedy of the commons. However, we can write a mathematical statement of the conditions under which death coming to the commons does not bring ruin to all the entrepreneurs. Where these conditions apply, the tragedy of the commons may appear to be occurring but in fact something quite different is really happening. The commons is being killed but someone is getting rich. The goose that lays golden eggs is being killed for profit.

The Inequality

I have no pretensions to neutrality, so the notation will be a little propagandistic. Let us say that a business is run responsibly if it is run in such a way that it could continue to run indefinitely. In many businesses profits can be raised for a period by running the business in a way which is not responsible. For example, a farmer might double profits for a period by overuse of the land. When a business abandons responsible tactics as defined above in favor of higher temporary profits we will say it is running *irresponsibly* or *fast*.

Let us imagine a business which derives its profit from the exploitation of some natural resource which renews itself - a whale fishery, perhaps. When this business is being run responsibly, it makes a certain profit. For a limited period of time, until the resource is depleted, it can be run irresponsibly at a higher rate of profit. This profit can then be invested, and a regular dividend collected from the investment. It is clear that, if the available investments provide sufficient return at no greater risk than that of a responsible business, and if the increased profits from irresponsible operation are great enough, the return from the investment of these profits will be greater than the businessman could obtain from responsible operation of his business.

That is, if the ratio of profits from an irresponsible business to the profits of a business responsibly run is great enough under given conditions of investment, it pays to run irresponsibly and invest the higher profits as fast as they come in. It pays for the businessman to kill his business.

The conditions under which it pays to be irresponsible are stated in the form of an inequality given as (1) in the box at the end of this article. The inequality defines the conditions under which a businessman can expect to be at least as rich from running his business fast as by running it responsibly, at every time from the beginning of the process onward (no matter how long). He can expect to be ahead not merely for the next five years. He can expect to be ahead forever. In addition, he no longer has to run the business.

For the convenience of any businessmen reading this paper, I have compiled the following table. In order to use the table, first estimate the rate of profit you might receive if you ran your business irresponsibly, and then calculate the ratio of this rate of profit to that derived from responsible operation. If the value of this ratio is greater than the "golden number" in the right hand column of the table, then it pays to run your business fast. To find your golden number, estimate the number of years (m) the business can run fast before the resource you depend on is depleted, and multiply it by the rate of investment return (s) available to you at a risk similar to the risk involved in your business run responsibly. Locate the product (sm) of these two numbers in the left hand column of the table; your golden number will then be the corresponding one in the right hand column. (The symbols at the head of the columns are those used in the derivation of the inequality given in the box.)

sm	golden number $e^{sm}/(e^{sm}!1)$
0.1	10.5
0.2	5.5
0.3	3.7
0.4	3.0
0.5	2.5
0.6	2.2
0.7	2.0
0.8	1.8
0.9	1.7
1.0	1.6
1.1	1.5
1.2	1.4
1.3	1.4
1.4	1.3
1.5	1.3

Approximations In writing this article I have made several rather coarse approximations. I have assumed that in an irresponsibly run business money will come in at a fixed rate and then suddenly stop. Perhaps one could get a better approximation by assuming a linear or exponential decrease beginning after some period of income at a fixed rate. I have also written in the inequality a condition under which running irresponsibly leaves the businessman ahead for all time. This is perhaps stronger than necessary. A businessman could profitably decide to run irresponsibly if it would put him ahead at some future time rather than at all future time. If a more careful version of the inequality were derived using either of these ideas we might find several businesses in which, using the above table, it appeared that it did not pay to run irresponsibly, but using the sharper version it would turn out to pay after all. In mathematical language, the inequality stated here gives a sufficient condition, but not a necessary condition, for killing the goose profitably.

Throughout this paper I have ignored two major effects, namely the effect of taxes and the problem of extracting invested capital. Large corporations can often deal efficiently with tax problems. For a business which cannot do so, the inequality may have to be applied by computing after taxes. The second problem, extracting invested capital, may cause a business which appears to be able to run irresponsibly to have to run responsibly after all. This would be especially true in a business involving a large capital investment in a physical plant which is not readily modified.

Conclusions

A condition has been described under which a business depending on a renewable resource may be run irresponsibly (destroying the resource) and not result in loss of income to all of the businessmen involved. Taking advantage of such a situation has been termed "killing the goose" and is different from the tragedy of the commons. The characteristic difference is that the long-term economic interests of at least one of the entrepreneurs are not harmed by destroying the resource. As there are businesses which have demonstrably depleted the resources on which they depend (whaling, for instance), killing the goose is not purely hypothetical. There may be businesses doing it now.

It is a common practice of conservationists to issue warnings of the coming tragedy of the commons to businessmen engaged in destroying a renewable resource. It is a common practice for businessmen to ignore them. Perhaps this article has shed light on the reason. The businessman may have realized more or less explicitly that he is in a position to kill the goose and that the conservationists' economic arguments are simply false. Further economic argument by the conservationists is then pointless. He must go back to his real reason for arguing and try to convince society to protect the resource. If he cannot do so he fails and the resource will be destroyed.

This article also indicates that in certain situations, namely those where it may pay to kill the goose, "industrial self-regulation" is not merely questionable, it is farcical. It is in fact equivalent to a policy of destroying the resource in question.

In such situations society is the only possible protector, of the resource, and any, efforts directed to protecting the resource without government intervention are doomed to fail in the long run.

NOTES

1. Hardin, Garrett, "The Tragedy of the Commons"
162:1243-1248, December 13, 1968.

Deriving the inequality

We define the following terms:

N_r = profit rate for responsibly run business (dollars per year).

N_i = profit rate for irresponsibly run business (dollars per year).

s = dividend (interest) rate on available investments (dollars per dollar years).

m = time business can be run at profit N_i (years).

We will show that if

$$(1) \quad \frac{N_i}{N_r} \exists \frac{e^{sm}}{e^{sm} ! 1}$$

then it pays to run irresponsibly and invest the (higher) profits at the rate "s" as fast as they come in.

Let N be a profit either N_i or N_r. Let t represent time and T(t) the total money accumulated at time t under the profit N. Thus T_r corresponds to N_r and T_i to N_i.

$\frac{dT}{dt}$ is the rate of accumulation of money.

Money comes in from profit at a rate N and from investments at a rate sT(t) [since T(t) is the total that is invested at time t]. Let us assume T(O) = 0.Then we have

$$(2) \quad \frac{dT}{dt} = N + sT, \qquad T(O) = 0$$

It is well known that such a system has only one solution, T(t).

Since

$$\text{(3)} \quad \frac{dT}{dt} = \frac{N}{s}(e^{st} ! 1) \qquad T(O) = 0$$

solves system (2) it must be the (only) solution.

Therefore if we assume a responsible business, the total money accumulated by time t will be given by

$$\text{(5)} \quad T_r(t) = \frac{N_r}{s}(e^{st} ! 1).$$

If we assume an irresponsibly run business, then at the end of m years the total will be

$$\text{(6)} \quad T_i(m) = \frac{N_i}{s}(e^{st} ! 1).$$

After t > m the only income will be from interest and equation (2) must be replaced.

$$\frac{dT_i}{dt} = sT_i$$

$$\text{(7)} \quad T_i(m) = \frac{N_i}{s}(e^{sm} ! 1)$$

whose solution is

$$\text{(8)} \quad T_i(t) = \frac{N_i}{s}(e^{sm} ! 1)e^{s(t!m)} \quad (t > m).$$

We are interested in finding out under, what conditions $T_i(t) \exists T_r(t)$ for all t. If t # m clearly $T_i(t) \exists T_r(t)$, so we need only consider t > m. Then subtracting (5) from (8)

$$T_i(t) ! T_r(t) = \frac{N_i}{s}(e^{sm} ! 1)e^{s(t!m)} ! \frac{N_r}{s}(e^{st} ! 1)$$

$$\text{(9)} \quad T_i(t) ! T_r(t) = \frac{1}{s} e^{s(t!m)}\{N_i(e^{sm} ! 1) ! N_r e^{sm} + N_r e^{s(m!t)}\}.$$

Since $N_r e^{s(m!t)}$ is never negative,

$$(10)\quad T_i(t) ! T_r(t) \exists \frac{1}{s} e^{s(t!m)}\{N_i(e^{sm} ! 1) ! N_r e^{sm}\}.$$

The right side of (10) is positive if $N_i(e^{sm} ! 1) ! N_r e^{sm} \exists 0$, i.e., if

$$(1)\quad \frac{N_i}{N_r} \exists \frac{e^{sm}}{e^{sm} ! 1}$$

which is inequality (1).