

## ECN 275/375 Environmental and natural resource economics

### Reputation based models – why $\rho_3 < \rho_1$

Recall that the solution to the basic model of ME for guaranteed compliance is  $\rho \geq \frac{\pi_N - \pi_C}{S}$

where  $S$  is the penalty if monitored and caught in non-compliance,  $\pi_N - \pi_C > 0$  is the benefits of cheating. Note that for cheating the state contingent payoff of non-compliance when not caught,  $\pi_N$ , must exceed the state contingent payoff under compliance,  $\pi_C$ .

In the reputation ME model, let  $\rho_3$  be the necessary monitoring probability for securing compliance in group 3 (habitual non-compliers). Use the same terminology as under the basic ME model, and add the term  $M > 0$ , the monitoring costs that habitual non-compliers must pay every time they are monitored regardless of being found in non-compliance or compliance.

The condition for compliance is, as for the basic ME model, that the expected payoff of compliance must be greater than or equal to the expected payoff of non-compliance. This gives:

$$\begin{aligned}
 E(\text{compliance}) &\geq E(\text{non-compliance}) \\
 \rho_3(\pi_C - M) + (1 - \rho_3)\pi_C &\geq \rho_3(\pi_N - S - M) + (1 - \rho_3)\pi_N \\
 \pi_C &\geq \rho_3\pi_N - \rho_3S - \rho_3M + \pi_N - \rho_3\pi_N - \rho_3M + \rho_3M \\
 &\Rightarrow (\text{remark: colored terms cancel}) \\
 \pi_C &\geq -\rho_3S + \pi_N \\
 -\pi_N + \pi_C &\geq -\rho_3S
 \end{aligned}$$

$\Rightarrow$  (remark: multiplying throughout with -1, reverses greater-than-equal sign)

$$\rho_3 \geq \frac{\pi_N - \pi_C}{S}$$

We observe that the monitoring probability for the group *habitual non-compliers* equals the monitoring probability in the basic ME equation.

In a 3 group model, group 3 agents (and in a 2 group model, i.e., without a “purgatory” group 2 agents) are charged the monitoring fee  $M$ . This reduces group 3 profits by  $\rho_3M$  (and for 2-group models by  $\rho_2M$ ). In brief: in the worst classification, agents pay the monitoring fee themselves.

Habitual compliers (and firms in group 2, the purgatory), do not pay  $M$ , which means that the extra costs of being in group 3, also lowers the probability for securing compliance in groups 1 and 2, i.e.,  $\rho_1 < \rho_2 < \rho_3 \leq 1$ . Hence, reputation based models secure compliance at a lower monitoring effort than the basic model, which implies cost savings to society.

Remark: This impact is even more pronounced in 2-group models, as group 2 agents pay the monitoring fee. Then  $\rho_1 < \rho_2 \leq 1$ .