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Infectious Disease Detection with Private Information

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Infectious Disease Detection with Private Information

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Introduction

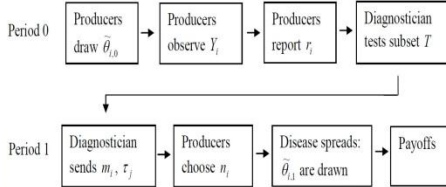
Early detection of an outbreak of an infectious disease—arguably the most important factor in reducing economic losses from a disease epidemic—has received surprisingly little attention from economists. For many infectious crop and animal diseases and invasive species, farmers are in the best position to report warning signs such as deviations from normal plant growth or increased animal mortality. However, governments cannot control whether a farmer decides to report signs of a plant or animal disease to a government agricultural body or a veterinary office.

Research Questions

When do farmers truthfully report their suspicions to veterinary agencies? Can an indemnity policy incentivize truth-telling? Does mandatory disease control make more or less likely that reports are truthful? Do diagnostic tests necessarily increase welfare when reports are not informative? Are larger groups of farmers more or less likely to report truthfully?

Model

Farmers: infected or not infected, observe symptoms, send reports, control disease by depopulation
Diagnostician: allocates limited diagnostic tests
Disease Epidemiology: Each farm is stochastically infected in period 1, Disease stochastically spreads in period 2



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Main findings

1. Farmers report their suspicions truthfully in the regime with voluntary disease control when they know disease symptoms sufficiently well, disease is unlikely to enter the region, and the number of farmers is sufficiently small.
2. Compliance with mandatory disease control can make it easier or more difficult to sustain truthful reporting
3. Private information is irrelevant and random testing is optimal under mandatory depopulation of untested animals.
4. Random testing decreases welfare under voluntary disease control when the number of producers is small and private information is sufficiently precise
5. Credible reporting and the first-best test allocation are achievable without transfers under mandatory disease control, if private information is precise, the disease occurrence is unlikely, and the diagnostic capacity is small.

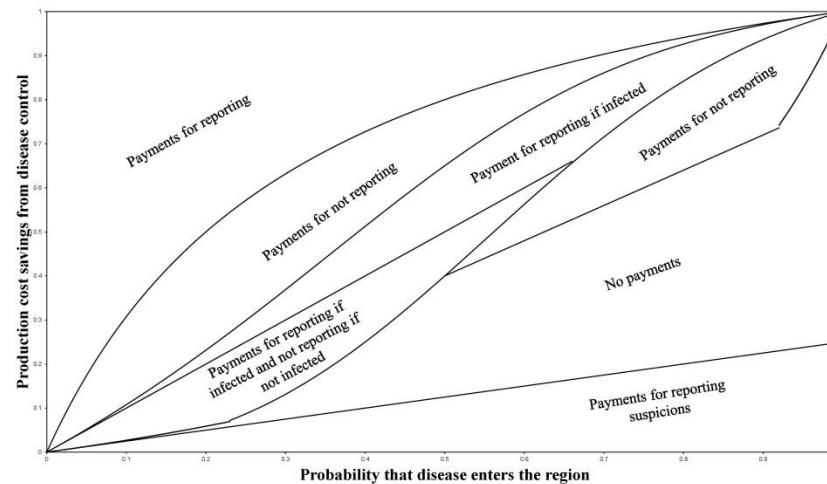
Conclusions

Our model of reporting suspicions and early detection of a controllable infectious disease focuses on the informational consequences of reporting. The previous literature views reports of local disease incidence as signals that determine the cost of compliance with an *exogenous* government disease control policy. In our model reports do not directly affect payoffs but are inputs in the surveillance program that may or may not include mandatory disease control. We have found that even without mandatory depopulation, the incentives to manipulate a disease surveillance program exist and better information about local disease incidence is valued differently by different producers.

The implementation of an efficient allocation of a diagnostic resource based on cheap talk with multiple senders depends on the details of the environment such as the number of senders, the likelihood of disease occurrence, and the precision of private information as well as institutional characteristics such as the feasibility of mandatory disease control, diagnostic capacity, and the cost of administering monetary transfers.

An interesting topic for future research is to consider the design of a compensation scheme that incentivizes truthful reporting of clinically suspect cases and the allocation of diagnostic efforts in a fully dynamic susceptible–infected–recovered model (SIR) of an infectious disease.

Optimal Compensation Policy



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