

Abstract of Thesis/Dissertation

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Title : Economic analysis of farmers' behavior and incentive towards African swine fever control in Madagascar

(マダガスカルのアフリカ豚コレラ対策における農家行動とインセンティブの経済分析)

Abstract

Agriculture is the main support of Africa's rural livelihoods. Particularly, many rural African farmers depend heavily on livestock. Most of the farms are small scale, with a herd size of less than 10 pigs per household, and pigs constitute a major source of income, emergency fund, or saving for the farmers. Therefore, animal diseases pose major threats to livestock sectors in Africa. African swine fever (ASF), which is one of the most feared pig diseases, is prevalent in 28 African countries. ASF is a disease of high economic impact because of its high mortality rate that can be up to 100%. Therefore, ASF control is needed in order to protect farmers' livelihood.

In Madagascar, pigs represent a source of income and saving for pig farmers. In addition, pig production in the country is not sufficient for domestic consumption. Unfortunately, ASF is endemic in Madagascar and constitutes a constant threat for farmers. Therefore, it should be eradicated in order to guarantee the development of pig production. One of the main strategies in controlling ASF is stamping out, which requires the farmers' collaboration in reporting cases or suspected cases. For animal disease control in developed countries, farmers are given compensation for the slaughtered animals to create incentive to report cases. However it is not yet done due to Malagasy government's budget limitation and weak monitoring system. The general purpose of this study is to draw policy implications for a successful control of ASF by focusing on farmers' behavior. To accomplish the general purpose, this study comprises of three main analyses.

The study was conducted in the Analamanga region which records the second

highest number of pigs among the 22 regions in Madagascar. A data collected by face to face interview in December 2013, from 201 farmers was used for the first two analyses. In June 2016, 116 farmers were interviewed for the third analysis.

Currently, Malagasy pig farmers are prohibited from selling the ASF infected pigs by a law, and encouraged to report ASF suspicion to the government in order to control the spread of the disease. However, stamping out is not conducted; instead, farmers are encouraged to isolate infected pigs. Previous literatures have shown that farmers' knowledge towards animal disease affect their behavior for facing animal disease and the same situation might be seen in Madagascar. It means, farmers may sell the infected pigs illegally if they lack knowledge about the factors that spread ASF, which is assumed to be a sensitive behavior because of the law. The objective of the first analysis (Chapter 3) is to suggest policy measures to limit farmers' sensitive behavior that spread ASF. To evaluate their knowledge about the disease farmers were interviewed using questions related to ASF severity, transmission and symptoms. Additionally, we used the item count technique (ICT), an indirect question technique appropriate for measuring the proportion of people engaged in sensitive behavior, for one subsample, while another subsample was asked directly whether or not they sell ASF-infected meat. The behavior is considered sensitive when the estimate from ICT is statistically higher than that from direct questioning. One interesting result about the knowledge question is that 28% of farmers wrongly believed that ASF can affect human. Based on the ICT, approximately 73.2% of farmers who have experienced ASF sell the ASF-infected meat. This estimate was not statistically different from that obtained by direct questioning. In the farmers who believe ASF can affect humans, the ICT yielded a higher estimate than direct questioning; indicating that pig farmers who sell ASF-infected pig hide that fact because of their belief that infected meat might harm human consumers, not because of the law. In the case of ASF outbreaks, the Malagasy government must be stricter about applying the law, and control ASF by stamping out.

If the law that prohibits selling of ASF infected pigs is strictly enforced, farmers whose pigs will be infected face income shock during outbreak. For a successful stamping out, farmers are supposed to report ASF case to the government. However, the health status of the pigs is private information that only the farmer knows, and he might be unwilling to reveal it to the government. This situation is an asymmetric information issue. The objective of the second analysis (Chapter 4) is to determine economic incentive for farmers for an effective control of ASF. Since farmers' knowledge about ASF was found to affect their behavior in the previous analysis; we hypothesize that it is also a factor that influences their attitude towards compensation. The contingent valuation (CV) technique was used to estimate their WTA compensation for culled pigs. The result show that less farmers who does not have ASF experience have knowledge about ASF symptoms compare to that with ASF experience. The CV results show that, as compensation increases, more farmers are willing to report ASF cases. However, the

probability of reporting depends on certain farm-related characteristics, namely, farmers' knowledge about ASF, administration of the classical swine fever vaccine, and experiences with ASF. The results indicate that providing adequate financial compensation is important for incentivizing the reporting of ASF outbreaks. Even so, it is necessary to also conduct an awareness campaign on ASF's economic impact to prevent farmers who know that ASF is not harmful to human health from rejecting compensation. In another words, farmers' knowledge about ASF transmission should be improved.

Without compensation program, farmers have to recover their income by selling ASF infected meat. Moreover, other farmers will show their support by buying the ASF infected meat. That behavior is encourage by *fihavanana*," a social norm that guides mutual support behavior in Madagascar. Buying ASF infected meat constitutes a risk of ASF spread when the farmer practices swill feeding. Nonetheless, the reason of unavailability of compensation program is government's budget limitation. Therefore, the third analysis (Chapter 5) aims to examine the impact of economic incentive on ASF control taking *fihavanana* into account. System dynamic modeling was used to simulate the spread of ASF by taking into account the different factors that affect ASF spread, such as biological, economic and social factors. Different scenarios were simulated by varying the level of compensation given to farmers from 50% to 70% of farm gate price of meat. Afterwards, a cost benefit analysis was performed. The results show that all farmers who bought ASF infected pigs cited *fihavanana* as the main driver of this helpful behavior toward their fellow farmers. Moreover, if farmers receive compensation for culling ASF infected pig, the system dynamics model shows that fewer pigs are infected compared to the situation where the compensation is not given. In addition, compensation strategy is cost effective in the sense that the benefit is much higher than the cost, regardless of the level of compensation. Hence, in addition to the provision of compensation, the government should discourage farmers from practicing *fihavanana* in the case of an ASF outbreak.

For a successful control of ASF, there should be improvement of farmers' knowledge and enforcement of the law that prohibits selling of ASF infected pig. As an accompanying measure, financial compensation should be given to the farmers in order to first incentivize them to report ASF cases and second to avoid the farmers' necessity to support mutually. Certainly the current government's budget is not enough for compensation; nonetheless almost all the budget is allocated crop production development. Undernourishment in Madagascar is related to lack of animal protein supply which indicates that Malagasy government should devote more money for livestock development.