ECONOMIC LOSS AND CONTROL EXPENDITURE FRONTIER CURVES IN MILK PRODUCTION

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In animal production, it is often asked if treatment or control expenditures pay off at the same or higher levels. Among recent approaches to estimate the economic impact for disease and control measures within the milk production system are simultaneous equation models [(8)] and loss and expenditure frontier curves [(6)]. Modelling the effect of disease control measures on production is conceptually more appropriate through their impact on the disease incidence level. For this, a relevant method is the Seemingly Unrelated Regression estimation tool within a system model framework. It accounts for information contained in the relationship between diseases and causes common to these diseases. The main objective of this study is to evaluate the economic impacts of mastitis control measures by amalgamating the above approaches.

Materials and methods

Data for this study are a sample of 2135 Danish dairy cows herds [(1) & (2)]. The mastitis control strategies emphasized in the analyses are dry cow therapy (DCT), teat dipping, udder massage, ointment treatment, shaving of the hair coat, natural medicine and combinations; other co-variates are also used in the analysis.

Data analysis include simultaneous-equation, seemingly unrelated regression models and Data Envelopment Analysis [(3)] to identify the frontier curve and peers. The simultaneous-equation models comprises 5 equations representing dependent variables of milk production, milk delivery to the creamery, bulk tank somatic cell count, the culling rate, and the reproductive index, and included 8 disease incidence rates as independent variables. The seemingly unrelated regression models comprise 8 disease equations for mastitis, lameness, ketosis, milk fever, other digestive, calving, reproductive and “other disorders”. The equations estimated the impact of related control strategies on the respective incidence rates. To improve the efficiency of estimates it utilises the sample information contained in the models contemporaneous correlations[(4)&(5)] . This estimation procedure was chosen to reflect the biological inter-relationship between production diseases and the impact of management or a stockman’s intervention on a particular disease that is transferred to another disease.

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For example, a prompt reaction towards retained placenta could improve the immunity of the stock and lead to a reduced in the incidence of mastitis. Likewise, the choice of feed and therefore the nutrition status of the cows influences the general level of disease incidences. However, these effects are part of the random error.

We use relevant prices and the estimated parameters from the two models to construct the loss and expenditure frontier curve(6). The estimated loss component of the total cost of mastitis control are based on the relationship between bulk tank somatic cell counts and milk production. However, this estimated loss is adjusted by the estimated mastitis incidence rate from the seemingly unrelated regression model. The value was then added to the estimated milk withheld due to mastitis. Finally, the estimate was adjusted for feed cost not incurred due to lost production (subtracted) and for the cost of replacement attributed the disease (added). The control expenditures reflect costs associated with veterinary services, medicine, other products and the labour associated with performing control measures. A simulation of the effect of different disease control mixes in a randomly chosen benchmark farm was done to investigate the various control strategy mixes and evaluate the current disease control strategy mix.