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Economics of Investing in the Health of Livestock: New Insights

by

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The Commissioned Organization is the Queensland Department of Primary Industries. Collaborating institutions in Australia are CSIRO-ANHL, Geelong, Victoria and the University of Queensland (Department of Economics; Department of Geographical Sciences and Planning). In Thailand, the collaborating institutions are the Department of Livestock Development (National Institute of Animal Health; Disease Control Division), Chiang Mai University (Department of Agricultural Economics; Department of Animal Husbandry) and Thammasat University (Faculty of Economics). The collaborating institution in Laos is the Department of Livestock and Veterinary Services. Dr F.C. Baldock, Senior Principal Epidemiologist, Queensland Department of Primary Industries is the Project Leader in Australia and Dr P. Chamnanpood, Senior Epidemiologist, Thai Department of Livestock Development is the Project Leader in Thailand. Professor Clem Tisdell and Dr Steve Harrison, Department of Economics, University of Queensland are responsible mainly for the economic component of this project.

'The overall goal of this project is to develop and evaluate the .necessary tools to provide decision-makers with reliable animal health information which is placed in context and analysed appropriately in both Thailand and Australia. This goal will be achieved by improving laboratory diagnostic procedures; undertaking research to obtain cost-effective population referenced data; integrating data sets using modern information management technology, namely a Geographical Information System (GIS); and providing a framework for the economic evaluation of the impact of animal diseases and their control.

A number of important diseases will be targeted in the project to test the systems being developed. In Thailand, the focus will be on smallholder livestock systems. In Australia, research will be directed at the northern beef industry as animal health information for this sector of livestock production is presently scarce.'

For more information on *Research Papers and Reports Animal Health Economics* write to Professor Clem Tisdell (c.tisdell@economics.uq.edu.au) or Dr Steve Harrison,(s.harrison@uq.edu.au) Department of Economics, University of Queensland, Brisbane, Australia, 4072.

ECONOMICS OF INVESTING IN THE HEALTH OF LIVESTOCK: NEW INSIGHTS?

ABSTRACT

Global populations of livestock have shown substantial increases as result of world development. Therefore, it is appropriate that more attention be given to the economics of animal husbandry. Interventions to improve or maintain the health of livestock are important aspects of such husbandry and are the focus of this paper. It is argued that there is a need to go beyond traditional economic analyses of this subject. In particular, there is a need to analyse the social economic impact of control of livestock diseases not only in terms of variations in markets for livestock products, but in terms of livestock markets themselves. This is more informative. In addition, measures to control livestock diseases should be looked upon as investments in maintaining or improving livestock capital or quality, but this has not been the standard approach to the analysis of the economics of decisions by holders of livestock. As demonstrated in this paper, new insights are attained by approaching the economics of livestock health from these two different perspectives.

Keywords: Animal husbandry, capitalised value of livestock, decision-making by fanners, economics of disease control, livestock health, social economic assessment of techniques.

JEL Classification: Q160

ECONOMICS OF INVESTING IN THE HEALTH OF LIVESTOCK: NEW INSIGHTS?

1. Introduction

Numbers of livestock in the world have increased tremendously in recent decades. For example, in the period 1961-1996, the number of the world's goats increased from 347.8 million to 689.2 million (an increase of 92 per cent), cattle from 941.4 million to 1,311.3 million (a rise of 39 per cent) and buffalo from 88.4 million head to 152 million (up 72 per cent) (FAO, 1996). This is partly a consequence of growing human populations and rising levels of per capita income in many low income countries, particularly in Asia. These factors have resulted in expanding demand for livestock products such as meat and milk. Overall the economic value and importance of livestock have multiplied with economic development. The economics of animal husbandry has assumed growing importance, not only from an environmental viewpoint but also in terms of material productivity. Maintaining the health of animals and controlling diseases of livestock forms an important part of this husbandry and it is the main topic to be addressed in this paper.

It is suggested that the economics of animal health and of the control of livestock diseases might usefully be analysed in a different way to that commonly adopted in the existing literature. Investment in animal health, which includes investments to control livestock diseases, should be looked upon as a capital investment, that is as an investment in livestock capital in an analogous way to investment in human health which is seen as adding to human capital (Becker, 1975; Landefield and Seskin, 1982; Rice, 1967; Weisbrod, 1971). One of the reasons for this is that most livestock have a relatively long duration of life and benefits from any health intervention, e.g. vaccination of livestock, are obtained over several periods of time. Nevertheless, most of the existing economics literature models the economics of control of animal disease as being like a single period production problem. Examples include the cost- benefit analyses of Mcinerney (1991) and Mcinerney et al. (1992). In addition, economists undertaking social assessments of the economics of improved animal health have normally measured changes in the social benefits by taking account of changes of producers' and consumers' surpluses in associated livestock products (Cf. Edwards, 1996; Johnston,

1975; Berentsen et al. 1992; Anaman et al., 1994; Patrick and Vere, 1994; Harrison and Tisdell, 1995). Apart from the fact that this modelling provides a rather limited measure of variations in social welfare (Tisdell, 1996, p.545) shortcomings arise because the changes are analysed only in relation to product markets with inadequate attention to their impact on factor markets. For example, in relation to livestock, changes in markets for meat or milk are considered rather than variations in the market for cattle. The analysis is, therefore, less comprehensive than is desirable and significant economic effects are liable to be overlooked. The intention is to illustrate this, using simple models, to consider the role of market prices of livestock in a capital-based approach to livestock health and by using very simple capital theory to provide some insights into decisions of livestock owners about their investment in livestock health.

2. Changes in livestock health and markets for livestock - neglected effects

In order to illustrate the value of considering economic impacts of changes in animal health by specifically considering factor markets, take a simple example. Assume that the demand for the product(s) from the livestock is perfectly elastic. This may be approximated in a world of free trade when the supply of any country is relatively small in relation to global trade in the product(s).

From the product market perspective, the economic consequences of improved animal health in a country are modelled as stemming from a shift downward of the supply curve of the product(s) of the livestock. The size and degree of this shift is usually treated as exogenous. For instance, in Figure 1, DD represents the demand for a country's livestock product X, and S_1S_1 is the supply curve of that product prior to an improvement in animal health. After an improvement in animal health, the supply curve of the product shifts to S_2S_2. The supply of the product increases from X_1 to X_2 and producers' surplus rises by an amount equivalent to the dotted area.

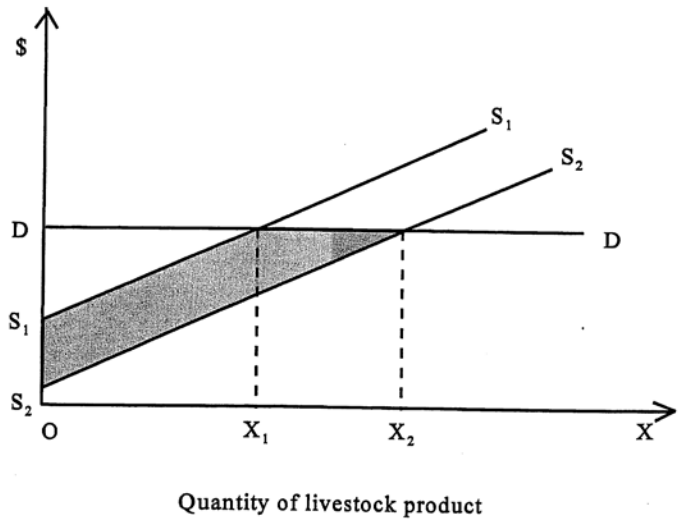

Figure 1: National benefits from improved livestock health modelled by changes in the product market.

All economic benefits of the national improvement in livestock health are appropriated by domestic producers of livestock.

However, modelling this change in terms of the product market seems less informative than taking account of the changed health of livestock in terms of the livestock market. Consider this alternative. If holders of livestock are profit maximisers their demand for livestock depends on the discounted value of the net marginal product of livestock. If the health of livestock improves either because of a favourable environmental change or because more efficient methods of managing livestock health become available, the discounted net present value of livestock rises. This is illustrated in Figure 2.

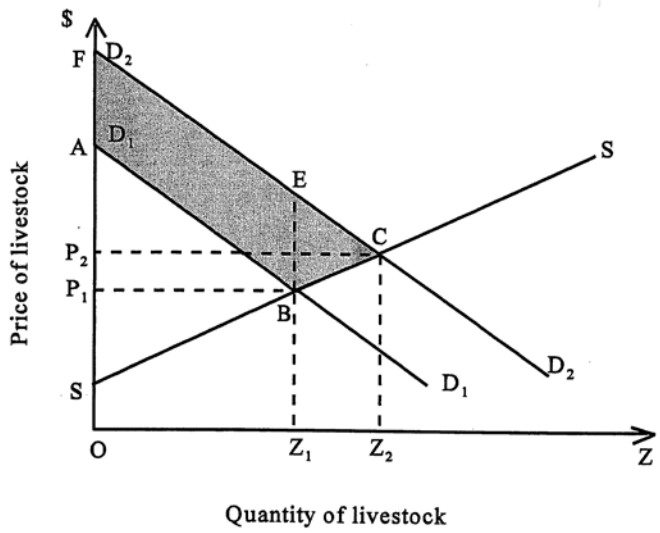

Figure 2: Economic benefits of improved livestock health- factor market approach.

In Figure 2, as improvement in animal health increases, the demand curve for livestock in a country shifts from D_1D_1 to D_2D_2 because of a rise in the discounted present value of the marginal product of livestock, the price of livestock products being assumed constant as in the previous example. While in the short-term the stock of livestock is fixed, in the longer-term it is not. The curve SS represents the long-term supply curve of livestock in the country concerned. In the long-term, holders of livestock receive profits equal to the dotted area. This can be decomposed into two parts (a) their extra benefits given existing livestock numbers (an amount equivalent to the area of quadrilateral ABEF) and (b) extra profits from extra livestock, an amount equal to the area of triangle BCE. These benefits may be estimated from actual productivity changes and livestock supply relationships. This makes for more precision than in the previous case.

Note that the economic impact of reducing or eliminating a disease of livestock may be much greater than the value of the extra direct productivity benefits. For example, suppose that a contagious livestock disease, such as foot-and-mouth disease is eliminated in a country or reduced in frequency. It may now pay to invest more in reducing other livestock diseases or in improving the quality of livestock. Because livestock become more secure, there is a better chance of recouping other investments in their improved quality. Thus an escalator effect on livestock quality occurs. Complementarity in disease control is present. After the escalator effect is taken into account, the demand curve in Figure 2 may rise above D_2D_2.

3. Decisions by livestock owners about investing in the health of their animals

A number of different methods may be used by livestock owners to decide whether an investment in the improved health of their livestock is worthwhile. One way is to compare outlays on improved animal health with the increased flow of net profits obtained, discounting these appropriately. Another might be to consider the change in market price for the animal which might be expected as a result of such investment. The market price of an animal should be equal to its discounted net present value if markets operate perfectly. An investment in an animal which improves its economic quality should be reflected in the price that it can command in the market. Therefore, in the simplest case, a livestock owner should be prepared to increase his/her investment in the health or quality of an animal up to the point where the additional market price obtained for the animal equals the marginal cost of the investment. To the extent that market prices represent the net present value of livestock, this may make it easier for owners to make decisions about investments in livestock health. However, asymmetry of information between livestock sellers and buyers may reduce the value of this approach (Cf. Akerlof, 1970; Varian, 1996). Nevertheless, this approach is worth exploring empirically to determine if it has promise.

Suppose that the internal rate of return from investment in the control of a livestock disease(s) can be determined. The marginal efficiency of capital or internal rate of return function for investment by a livestock .holder in his/her livestock might be like curve ABC in Figure 3. In this case, if the rate of interest is r_1, the owner would find it optimal to invest I_2 in improved animal health. At a higher rate of interest say, r_2, less will be invested. Furthermore, this marginal efficiency curve will be higher the higher are the prices of livestock products and of livestock, or the greater is the extra productivity from investment in livestock health. All these factors favour greater private investment in livestock health by owners of livestock.

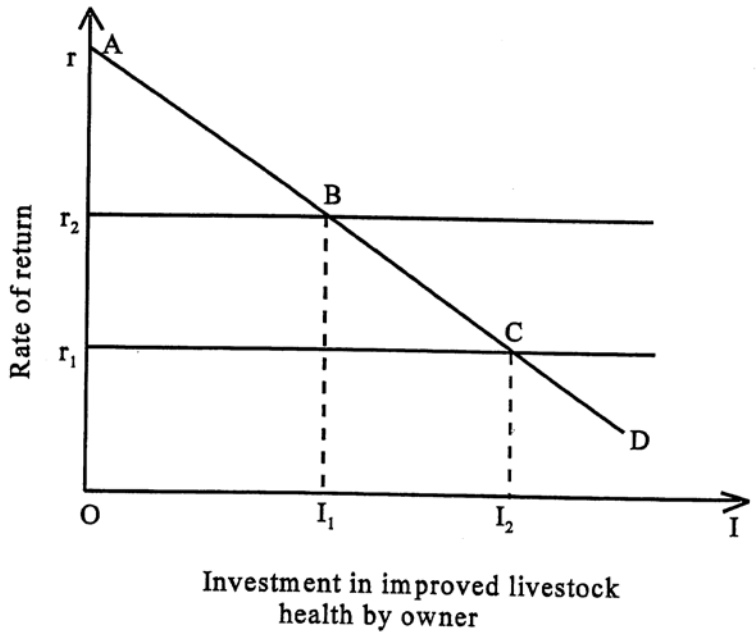

Figure 3: Simple model of investment in livestock health by owner of livestock.

It is sometimes observed that owners of livestock on lower levels of income invest less in the maintenance of health of their livestock than those on higher incomes. This appears for example to be so in Thailand. Several explanations are feasible: the former may have a higher discount rate due to their relative poverty- their effective interest rate may be r_2 rather than r_1. The higher interest rate of the poor may be due to a higher time discount or they may be forced to pay a high rate of interest for loans because they have little collateral and so lenders bear higher risks. In addition, they may be less able to invest in other complementary investments in animal husbandry. Therefore, in relation to Figure 3, the internal rate of return curve of poor owners of livestock may be lower than the one shown (ABCD) for a farmer on a higher income.

Note that the 'social' return from investment in the control of livestock diseases differs in some cases from the private return. Such market failure can be a reason for collective intervention in the control of diseases of livestock (Tisdell, et al., 1994). Yet if this intervention involves public costs, as usually is the case, the question arises of who should pay these costs. If the economic beneficiaries are restricted to the livestock industry, there is a strong case for the livestock industry to pay, e.g. through the imposition of a livestock levy.

4. Concluding comments

The economic importance of livestock needs greater recognition in agricultural economics. Livestock industries form a major and growing part of agriculture, and have significant environmental impacts. This paper suggests that more attention should be given to the economics of investing in and improving the quality of livestock, including their health. A new approach is needed because standard analyses of the economics of control of livestock diseases do not highlight the investment aspect and the enhancement of livestock as capital. Furthermore, it is claimed and illustrated that conventional analysis of the economic effects and benefits of controlling livestock diseases which rely on variations in markets for livestock products are not very informative. Analyses which focus on livestock markets are •more informative, and the analysis used here enabled effects to be identified which have not been previously mentioned in the literature. Livestock holders vary in the extent of their investment in the control of livestock diseases and in the level of their investment in improving the quality of their animals. Livestock capital theory can easily explain a number of these variations even assuming profit maximisation to be the main aim of livestock holders.

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