ESTIMATING THE COSTS ASSOCIATED WITH LIVESTOCK DISEASES – A STUDY OF 30 DISEASES OF LIVESTOCK IN GREAT BRITIAN

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This paper presents the method and some of the findings of a preliminary economic study of some 30 endemic diseases of farm animals in Great Britain (details of the analyses can be found at http://www.rdg.ac.uk/AcaDepts/ae/AEM/livestockdisea/).

Materials & Methods

Disease in livestock has seven main economic impacts. These are 1) the reduction in the level of marketable outputs 2) a reduction in output quality 3) a waste of inputs 4) resource costs associated with disease control 5) human health impacts 6) animal welfare impacts and 7) international trade implications.

Figure 1 shows the physical effect of disease on livestock production in terms of output losses and input/resource wastage. The presence of disease means that livestock producers operate on a lower production function than if there was no disease. Thus, instead of operating at point A on the 'no disease' production function with output level Ond and input level Ind, producers operate at a new equilibrium point such as B on the 'disease' production function with output level Od and input level Id. Disease has therefore resulted in both an output loss (Ond-Od) and a resource wastage (Id-Ind). In addition, resources are used in preventing and treating disease and without these 'veterinary inputs' livestock producers would be operating on an even lower production function, perhaps at point C in Figure 1.

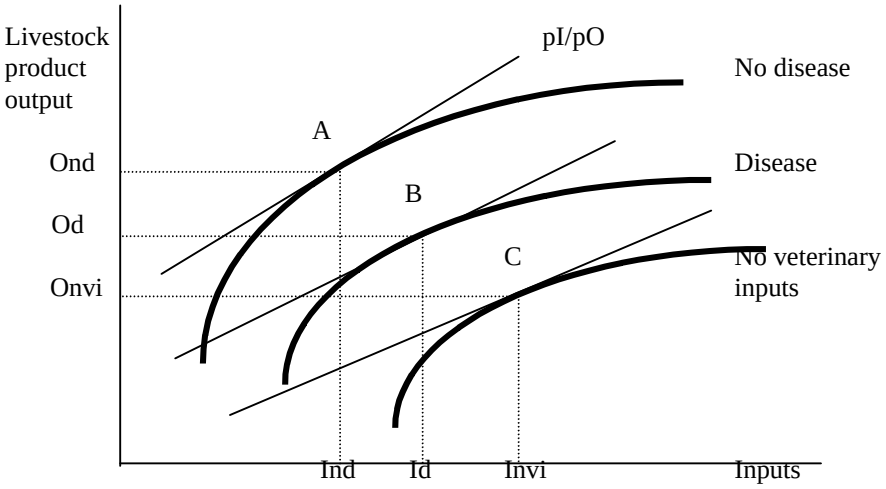

Figure 1: The effect of disease on livestock production

Spreadsheet models were developed to estimate the 'direct costs' associated with each disease. The 'direct cost' (C) is defined as the value of the loss in expected output and/or of resource wastage due to the disease (L), together with the treatment costs (T) incurred in trying to mitigate the effects of disease on production and the costs (P) associated with specific disease prevention (i.e., C = L + T + P) where:

$L = p\ i_d\ i_e\ e\ v_l$ for each disease effect (1)

$T = p\ i_t\ v_t$ for each type of disease treatment (2)

$P = p\ i_p\ v_p$ for each type of disease prevention (3)

and where p = size of livestock population at risk (000s); i_d = annual incidence of disease as a proportion of the population at risk; i_e = incidence of disease effects as a proportion of the affected population; e = magnitude of physical disease effects (e.g. litres of milk lost); v_l = unit value of lost output or resource wastage (e.g. £s/litre of milk lost); i_t = proportion of population at risk treated; v_t = cost of treatment per animal; i_p = proportion of population at risk where prevention measure taken; v_p = cost of prevention measure per animal.

All disease effects on production are related to estimates of output losses or resource wastage. 'Low' and 'high' estimates are given which reflect the variation in disease incidence over time and uncertainties due to limitations of the disease data available.

Results

Table 1 shows preliminary estimates of direct disease costs for the 18 diseases of cattle included in the project. The magnitudes of output losses/resource wastage should be considered in relation to expenditures on treatment and prevention.

Disease	*Output loss/resource waste*		*Treatment*		*Prevention*	
	low	**high**	**low**	**high**	**low**	**high**
Cattle						
BVD	5 (2)	31 (12)	-[a]	-	-	-
Enteric disease	1 (<1)	5 (2)	3	6	-	-
Fasciolosis	7 (6)	51 (25)	-	-	-	-
IBK	3 (1)	8 (3)	<1	5	-	-
IBR	1 (<1)	4 (2)	<1	2	4	4
Lameness	30 (14)	65 (32)	6	51	3	5
Leptospirosis	1 (2)	22 (12)	<1	3	1	-
Mastitis	57 (28)	185 (89)	45	78	4	4
Parasitic bronchitis	5 (4)	11 (8)	<1	2	2	2
Paratuberculosis	<1 (<1)	4 (4)	<1	<1	-	-
Pasteurellosis	<1 (<1)	<1 (<1)	<1	<1	<1	<1
Salmonellosis	<1 (<1)	4 (1)	<1	<1	-	-
Summer mastitis	7 (3)	13 (6)	<1	1	5	5

[a] Not applicable or no estimate available. Figures in brackets are estimates using 'border prices'.

Table 1: Estimates of the direct costs of 13 cattle diseases in Great Britain (million £).

There are large variations between 'high' and 'low' estimates of the value of output loss or resource wastage largely due to the range of annual disease incidence estimates and estimates of disease effects. Where there are no estimates of disease treatment or

prevention costs, either data were not available to estimate these or there are no treatment or prevention measures specific to the disease.

Discussion

The relative merits and limitations of the study are shown in Table 2. The most important aspect of the models is that they should meet the needs of policy makers.

Merits	Limitations
* Standardised estimation and common valuation base.	* Simplified representations of complex diseases with a danger of misrepresentation.
* Simple, transparent approach .	* Wider economic impacts not yet considered.
* Models structured according to epidemiologic principles and production systems.	* Original valuations based on market prices (but border prices now used).
* Parameter values, assumptions and calculations clearly documented and explained.	* Paucity of appropriate information for some diseases.
* Direct disease costs, treatment and prevention costs included and clearly distinguished.	* Lack of data on treatment and prevention confound estimates of 'direct' disease costs.
* Uncertainties about parameter values are highlighted and incorporated into the estimates.	
* Parameter values easily changed to test different assumptions, make updates etc.	

Table 2: Merits and limitations of the study method

There are four main limitations to the models at present. First, information on the incidence and effects of diseases may be lacking. Second, there are no evaluations of disease control strategies. Third, only the direct costs associated with the diseases are estimated and no account is taken of wider economic impacts, such as the effects on human health and animal welfare. Fourthly, valuations of input wastage and output loss are based on UK market prices which may be distorted (e.g. by market support).

First, the models help to identify areas where better information is needed and so can help guide research. The second limitation can be addressed by undertaking cost-benefit analyses for specific disease control strategies, using the models as a basis. The third limitation is important and it is intended that the models be developed to incorporate these considerations. The limitation of using market prices for valuing disease effects on production can be addressed by using 'undistorted' border prices as shadow prices to value inputs and outputs. Table 1 shows (in brackets) estimates of the direct costs associated with the 13 cattle diseases using border prices for outputs.

The study marks a useful start in developing a system for the economic assessment of a variety of livestock diseases. The next step is to develop the approach by incorporating wider economic considerations into the analyses in a way that will demonstrate to policy makers and others the importance of an economic perspective to livestock disease issues.