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ECONOMIC THEORY, APPLICATIONS AND ISSUES

Working Paper No. 64

**Animal Health Economics. What Can It Do?
What Are The Big Questions?**

by

Clem Tisdell

December 2010



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* A background paper prepared for a meeting of experts on Animal Health Economics to be held in London on 6th and 7th of December, 2010, organized by Dr. Jonathan Rushton, Royal Veterinary College, London, UK

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Animal Health Economics. What Can It Do? What are the Big Questions?

ABSTRACT

It is argued that while considerable development of animal health economics has occurred in recent decades, it has not yet achieved its potential coverage. It has been mostly applied to livestock, particularly livestock used for commerce, and its application to a range of other animals has been relatively neglected. Extending its coverage also requires widening the type of objectives taken into account in the analysis. Furthermore, the main focus of animal health economics has been on the economics of controlling and managing the occurrence of diseases. The economic role of genetics, the environment, nutrition and the comfort of animals in their health ought to be given greater attention. In the case of zoonoses, the economic analysis should be extended to take into account human health. Those studying animal health economics need to make decisions in their analysis about its spatial dimensions, its time dimensions, and the stakeholders to be considered. They must also take into account health chains and make allowances for risk and uncertainty. The economics of knowledge (including, for example, information economics and research and development) is worthy of more attention in animal health economics. Many important questions arise in animal health economics but two big ones might be: (1) what role should governments play in managing animal health and how should their involvement be financed; and (2) what precautions for maintaining animal health are economic? In conclusion, some reasons are suggested for animal health economics being unable to achieve its potential coverage.

Keywords: Animal health economics, diseases, health economics, information economics, precautionary principle, public economics, zoonoses.

JEL Classifications: I10,Q19

Animal Health Economics. What Can It Do? What are the Big Questions?

1. Introduction

Although considerable progress has been made in applying economics to animal health issues, as is evident from the valuable overview provided by Jonathan Rushton (2009), it remains a relatively neglected field of study for which many of its potential applications have yet to be explored. The main purpose of this article is to bring attention to unexplored areas to which animal health economics has application and to suggest that a wider, more integrated and holistic approach to it would be desirable. I am not very good at identifying ‘big’ issues but will identify a couple of issues that could be big issues.

First, I consider the type of animals to which animal health economics can be applied and point out that the range to which it has been applied is too limited and that the coverage of the subject has only been partly integrated. Then a variety of relevant economic objectives for animal health are discussed. This is followed by consideration of the need to make economic assessments of fundamental factors (such as genetics and environmental conditions) determining animal health. Important dimensions of animal health (such as spatial ones and those involving time) are given attention and the relevance of the economics of knowledge to the management of animal health is discussed before raising some big questions and concluding.

1. Types of Animals to which Animal Health Economics is Applicable

Animal health economics can be applied to many types of animals including both vertebrates and invertebrates. The range of animals include the following:

- (1) Livestock used for commercial or subsistence purposes. Livestock used for commercial purposes appears to have been given the greatest attention to date.
- (2) Animals, such as fish, used in aquaculture for commercial purposes or for subsistence. Aquaculture is growing in economic importance and is especially important in some countries, such as China. There is some literature on the economics of the health of aquatic animals but it does not get attention, for example, in Rushton (2009). This is probably a reflection of compartmentalisation in science, and the later global development of aquaculture compared to the husbandry of livestock.

- (3) Animals used as companions, pets for relaxation (such as dogs and cats) and ornamental fish are of interest from a health economics point of view. Some of these animals also are working animals such as dogs used as guards or for herding livestock.
- (4) Wildlife health is of economic interest because the presence or existence of wildlife may be valued in itself (or on occasions detested) and the health of these species may have spillover effects on the health of domesticated species, such as species of livestock.
- (5) Because of the web of life, species are interconnected and the economics of the health of many non-vertebrate species is also of interest. An example is bees. A disease has become prevalent amongst bees in the USA which has decimated their population. This has not only reduced the production of honey but has also reduced the ability of bees to pollinate some crops and flora. Consequently, in principle, it would be possible to estimate the economic loss involved and to provide economic assessments for controlling the disease once sufficient scientific evidence is available.

2. A Variety of Economic Objectives are Relevant to the Economic Assessment of Animal Health

From the above list of animals, it is clear that their owners may have a variety of different reasons or motives for considering the economics of having healthy animals. Those who keep livestock for commercial purposes will be interested in adopting strategies to improve the health of their stock if this is profitable. However, they also have an interest in how the health of their stock can affect their economic security and liquidity. Such factors can influence the varieties and types of livestock that farmers decide to keep and what preventative and curative measures they adopt.

In the case of subsistence and semi-subsistence farmers, the ability of livestock to contribute to the overall survival of their owners might have a high priority and subsistence farmers may give a higher weight to their security than commercial farmers. They may also be restricted in their available funds for investment in animal health. They may, therefore, be more inclined to keep disease-resistant local livestock rather than replace these with breeds of exotic livestock which are more productive on average but require more investment in the

maintenance of their health. This is one factor that contributes to dual livestock systems in some developing countries. This duality involves larger commercial holders of livestock adopting exotic breeds whereas household producers tend to retain domestic breeds or crosses of these with imported breeds. There is, for example, some evidence of the presence of a dual livestock system in Vietnam (Tisdell, 2010a). In many cases, the livestock products and services valued by subsistence farmers will also differ from those valued by commercial farmers and this also has implications for the economic benefit of improving animal health.

As mentioned, the health of aquacultured animals does not seem to have been integrated into the main body of animal health economics. While many of the economic considerations involved in assessing the economic benefits of having healthy aquatic animals will be similar to those in the case of terrestrial animals, new dimensions are involved. This is because the health of aquatic animals, such as fish, is more susceptible to the quality of their surrounding medium, water, than is the health of terrestrial animals to the quality of the air surrounding them. Ideally, textbooks on animal health economics should include some coverage of the economics of managing the health of aquatic animals.

Another neglected area in animal health economics is the economics of maintaining the health of companion animals, pets, animals kept for entertainment and relaxation, and those kept by hobbyists. The motives of owners for keeping these animals healthy are not commercial gain nor is it their contribution to subsistence living. Expenditure on maintaining the health of these animals seems to be high and to increase with income levels. There are many economic aspects of this health expenditure remaining to be explored.

In the animal health economics literature, the health of wildlife has mostly been given attention in relation to its impact on the health of livestock. Wildlife in several cases are vehicles for infecting livestock with contagious diseases and when they are a reservoir for such diseases, they make it difficult to eradicate these diseases. In Australia, feral animals (buffalo, pigs, goats and others) make it difficult to eradicate some diseases of livestock completely and constitute a particular hazard should some exotic livestock diseases, (such as foot-and-mouth disease) be accidentally introduced (Tisdell, 1982a, Ch.8). In Ireland and the UK, badgers are carriers of tuberculosis and consideration has been given to whether their eradication would be warranted on economic grounds in view of their role in infecting livestock (see Rushton, 2009, p. 206).

So far these studies do not appear to have taken into account the economic value of wildlife. They are, therefore, somewhat lop-sided. Several positive economic values can be obtained from the presence of wildlife. While economic methods for estimating these values are far from flawless, there has been considerable progress in developing these techniques, for example, the development of contingent valuation methods and choice modelling (see for instance Tisdell, 2005, Ch.7; 2009, Ch. 6). The benefits of eradicating or reducing populations of wildlife species in order to increase the healthiness of livestock and the economic returns from keeping livestock need to be compared with any losses in the economic value of wildlife in order to ensure that the relevant social cost-benefit analysis is not too restricted.

Note that maintaining the health of some wildlife species can have economic value in itself. For example, a new cancerous disease (devil facial tumour disease) is causing mortality amongst the Tasmanian Devil (*Sarcophilus harrisi*) and there are fears that it could wipe out its remaining wild population (Department of Primary Industries, 2010). Research is being partly supported with public funds (for example, by the Tasmanian Government) to find ways to combat the disease. This indicates that the continued existence of this species in the wild has an economic value. Given the development of social support for maintaining biodiversity, economic aspects of sustaining the healthiness of wildlife is likely to be of growing importance. The concerns of the general public about such matters were underlined by reactions to evidence that the use of pesticides (such as DDT in agriculture) threatened the reproduction of some bird species (Carson, 1963).

3. The Breadth of Economic Factors that Need to be Taken into Account in Animal Health.

Several basic influences on animal health are worthy of study from an economics point of view. These include genetics, the environmental conditions encountered by animals, their nutrition (including the availability to them of water and its quality) and their comfort. These factors all have consequences for the health of animals and for their susceptibility to diseases.

Consider genetics and the choice of a local breed versus an exotic breed of livestock, as an example. Potentially, the profitability of keeping the exotic breed is higher but it is more susceptible to local diseases. This risk can be reduced by adopting safeguards but these

safeguards involve a cost. Just how much the risk can be reduced by adopting safeguards will vary from locality to locality and so will their cost. In addition, the profitability of keeping an exotic breed will usually depend on a relatively narrow range (a package) of inputs being used in its husbandry. The costs and finance involved in taking health precautions as well as the remaining risks may deter subsistence producers (households) from favouring the exotic breed but commercial producers may adopt the exotic breed. Consequently, dual livestock systems can occur in developing countries.

Environmental conditions have been given considerable attention in relation to human health economics (Tisdell, 2009, Ch.13) but have been given much less attention in relation to animal health. Nevertheless, environmental improvements can contribute to animal health. Costs and benefits are involved in environmental improvement and therefore, cost-benefit analysis can be applied to such problems. Some environmental influences are under the control of individual livestock producers or owners of animals but others require communal action. For example, pollution of water from external sources or deficiencies of oxygen in water associated with spillovers in water caused by a high biological oxygen demand (BOD), can result in morbidity and mortality in cultured fish. Economic models can be used to assess the economics of altering the environments involved.

Deficiencies in the nutrition of animals, discomfort to them caused by poor housing and inadequate ventilation of housing, heat stress, and so, on can increase their proneness to diseases and result in increased morbidity or mortality. Again, economic considerations are involved in the management of such factors. Some species, breeds or strains of animals are more prone to stress caused by such factors than others. For example, Yorkshire White pigs imported by Vietnam from Queensland, Australia, to improve its pig population show greater heat tolerance than breeds imported from Europe.

Institutional features of animal husbandry also have implications for animal health, especially the spread of diseases and their control. For example, when cattle owned by different households share grazing lands or congregate at drinking points, this is likely to facilitate the spread of infectious diseases. Livestock holders who buy in stock rather than raise their own stock may be at greater risk of introducing diseases to their herds. Therefore, the marketing of livestock has a number of animal health implications from an economics point of view.

4. Important Dimensions in the Analysis of Animal Health Economics

Coverage of animal health economics can involve a variety of dimensions. These include spatial dimensions, dimensions involving time, differences in the range of stakeholders taken into account, consideration of different health pathways and elements of these as critical factors in managing animal health, and allowances must be made in economic analysis for risk and uncertainty affecting decision-making about animal health. Consider each of these dimensions in turn.

Spatial dimensions

Spatial dimensions can vary from the taking into account the economic consequences of the state of animal health on individuals (for example, owners of livestock), to a consideration of their economic consequences for local communities and regions, for industries, for nations and internationally or globally. Animal health policies that are socially economic for one group may not be the best economic choice for a wider group. For example, while it may not pay an individual country to try to eliminate an infectious animal disease, the net benefit of doing so could be positive from an international perspective.

The time dimension

Probably, the most frequent way of taking into account the time dimension in animal health economics is by the use of discounting of future costs and benefits when undertaking cost-benefit analysis. Several examples are given by Rushton (2009, pp. 124-125). He points out (Rushton, 2009, p.124): “The data requirements of social cost-benefit analysis are very high. The final analyses are often very sensitive to small changes in assumptions of discount rates, adoption rates and changes in livestock production parameters”. Furthermore, there is often disagreement about what is the appropriate discount rate, especially the appropriate social discount rate. To some extent, analysis of this type is relatively static. There are other dimensions of time that can be more important but which are often neglected.

These includes trends in the relative importance of different animals (for instance in their comparative levels of population) and in the way they are kept. These trends are often associated with features of economic development and can have important implications for animal health. Such trends help identify issues in animal health economics that can be expected to grow in importance. For example, as incomes rise and food chains lengthen, one might expect greater focus on health and hygiene in relation to the sale of animal products and more attention to the economics of measures to improve health and hygiene (Tisdell,

2010b). As populations of pigs and poultry increase relative to those of ruminants, the economics of controlling diseases of the former species increases in relative importance, as do any zoonoses or potential new zoonoses associated with these animals.

Stakeholders to be included

The question naturally arises in economic assessments of animal health about which stakeholders should be taken into account in these assessments. Should the analysis be confined only to the interests of owners of animals or should it be extended to buyers of products associated with the animals or to members of the general public who might experience adverse external effects from the ill health of animals? This also has a spatial dimension, for example, should the economic analysis be limited to considering only the economic interests of domestic livestock holders?

Pathways and cycles involved in ill health in animals

A causal chain is often involved in ill health in animals and the transmission of disease to humans in the case of zoonoses. It is necessary to study such chains (and cycles) where relevant to determine the most economic point(s) at which to intervene in the chain to address its consequences for ill health. Sometimes, it is uneconomic to intervene in this health chain in animals if zoonoses are involved. It is sometimes most economic to take action at the human end of the chain. For example, this might be done by inspections to reject meat that might cause ill health in humans, by ensuring in some cases that meat is frozen to kill parasites (as in the case of Australian wild pig meat, Tisdell, 1982a, Ch. 8) or by ensuring that the meat is well cooked before consumption and so on.

Risk and uncertainty

For purposes of simplicity, many economic models assume that economic possibilities are certain. In practice, however, risks and uncertainty are pervasive. Two main questions arise in relation to this subject. These are (1) how best to specify risk or uncertainty and take account of aversion to its presence and (2) how to determine the most economic way of responding to or coping with risk and uncertainty.

There are differences of opinion about how well uncertainty can be specified. At one end of the spectrum are those who advocate reducing situations involving lack of certainty, to ones involving probability by using objective probabilities where available, or subjective probabilities where objective ones are not available. Some reject this approach and argue that

not all uncertain situations can be quantified in this way. Tisdell (1968, Ch.2) reviews this subject. There are also issues about the extent to which risk-aversion should be allowed for in decision-making models and the way in which it ought to be specified.

Coping with uncertainty also involves economic consideration about what actions or precautions should be taken if there is uncertainty about outbreaks of diseases or other unpredictable manifestations of ill health in animals. For example, to what extent is it economic to keep vaccines or medicines on hand to respond to the possibility of an outbreak of an animal disease? This area of investigation overlaps with the economics of knowledge or information.

5. The Economics of Knowledge – Information Economics and Research Development

The economics of knowledge is an important subject. Its significance has been stressed by the Austrian School of Economics. Several aspects of it are relevant to animal health economics but I'll only mention two aspects: information economics and research and development.

Information economics and animal health

Information economics is relevant to most aspects of animal health. Economics is involved in the following:

- (1) The monitoring (surveillance) of animals to detect signs of ill health. How much should be spent on this?
- (2) The diagnosis of disease and other factors influencing animal health. What is the economic value of more rapidly diagnosing a disease or increasing the accuracy of the diagnosis?
- (3) The data that should be collected and stored can be assessed from the point of view of its potential economic value.
- (4) Knowledge about animal health can be important in relation to economic transactions (exchange). Issues involving asymmetry of information and moral hazard arise. In relation to the exchange of animals, it may be unclear to buyers whether animals being sold have been exposed to infectious diseases or vaccinated against specific

diseases. In the case of the sale of animal products for consumption, inspection by buyers may fail to reveal any health hazards posed by these products.

- (5) While limited information (data availability) about economic aspects of animal health restrict the scope for drawing rational inferences, bounded rationality does not imply that no rational inferences can be drawn. Therefore it is important to consider how the limited available information about animal health can be used to make rational decisions about the economics of its managing animal health.

Research and development

Research and development is a means of adding to our knowledge or information and can be subjected to economic assessment. For example, a number of studies have been completed to assess the ex post returns to investment in agricultural R&D. In addition, social cost-benefit evaluation of research projects are often attempted even though uncertainty tends to limit the accuracy of such procedures. Research and development (R&D) activity (including that of relevance to animal health) is plagued by market failures and there can be significant differences between the private returns from this activity and its social returns. In undertaking R&D projects, most individuals or businesses can be expected to be motivated by the private economic returns that they can appropriate. These are often much lower than the social returns from R&D projects and the degree divergence varies for different research projects. Consequently, the private allocation of funds for R&D can diverge significantly from its socially optimal allocation.

Advances for improving animal health that can be patented and for which enforcement of property rights is relatively easy can be expected to be favoured by private enterprise. Improved animal husbandry procedures that do not add to sales by private firms are unlikely to be researched by them. Because of market failures, economic arguments exist for some government involvement in R&D relating to animal health. However, public organizations are also subject to economic failures, for instance for political and other reasons, and they can lose sight of economic goals and become inefficient.

The economic benefits from R&D advances that can improve animal health also depend on their application and the diffusion of knowledge about them. Once again, these are matters that raise economic issues.

6. Big Questions for Animal Health Economics

Public economics and finance questions

A continuing big question in animal health economics is what aspects of the management of animal health should be the responsibility of governments (including international public organizations) and what areas of this management should be left to private individuals and organizations? An associated issue is how should government involvement in the management of animal health be financed? For example, should the general public pay for border surveillance designed to reduce the risks of exotic animal diseases being introduced to a country or should there be levies on owners of animals to pay for this? To what extent is it justifiable for the government to require owners of animals to adopt measures (such as vaccinations) to control animal diseases? Presumably, economic considerations would play an important role in decisions about this. Whether or not one would go so far as to accept Posner's wealth maximization principle as the basis of legal justice is questionable. Posner (1981, 1985) argues that legal actions that increase economic wealth are as a rule just (see Tisdell, 2009, Ch. 4).

The economics of precaution

Another important issue is how economic is it to be prepared for the occurrence of ill health (for example, disease) in animals. This includes the possible occurrence of existing diseases (including exotic diseases) and new diseases such as those associated with pandemics. Precautionary measures are not always justified from an economic point of view (Tisdell, 2010c). Some animal health precautions cannot be justified on the basis of the precautionary principle and Rushton (2009) cites several studies indicating that after the late 1980s, vaccinating livestock against FMD in Europe was no longer an economic precaution. This implies also that what constitutes an economic precaution changes with altering circumstances.

Consequences of animal health and husbandry for human health will continue to be important and are likely to grow in importance as incomes rise. The issues involved extend beyond the potential economic importance of zoonoses. They include, for example, questions about the implications for human health of growth hormones administered to livestock, the feeding of genetically modified food to animals, and the use of antibiotics to treat or prevent disease in animals. There is particular concern about the latter practice because it can increase bacterial resistance to antibiotics in diseases that also affect humans (Tisdell, 1982b). Many of the

other issues already mentioned are also in need of greater attention, such as aspects of the economics of knowledge in relation to animal health and the importance of undertaking economic assessments of animal health in the context of evolving, changing or developing situations. The contexts in which economic assessments of animal health are required seem to be always altering.

7. Concluding Comments

As is evident from the overview provided by Jonathan Rushton (2009), considerable progress has been made in developing and applying health economics in recent times. Despite this, its coverage is still much below its potential, as has been highlighted in this article. This is partly a result of the nature of the supply of funds for developing the subject. This is influenced to a large extent by political considerations and responses to short-term crises. There is a risk that demand-driven research on animal health economics will result in the neglect of basic questions and issues of long-term importance.

It is also true that animal health economics is not a ‘stand alone’ subject. It needs to be embedded in the results from relevant scientific research and therefore, an animal health economist must at least familiarize himself or herself with this research. A transdisciplinary approach is needed.

Shaw (2009) makes out a strong case for extending the coverage of animal health economics. Given the prevalence of zoonoses, she emphasises the importance of taking account of human health as well as animal health in the economic evaluation of animal diseases. She is correct that the focus of animal health economics is still too narrow. This is partly a reflection of the modern tendency for specialization in scientific research. While we need specialists, we also need generalists or more particularly, those who integrate different areas of research. The latter seem to be in limited supply, probably because rewards in academic systems tend to favour specialists rather than those who synthesise research from different academic disciplines.

A further factor that appears to limit the development of animal health economics is that it is treated as a marginal or peripheral subject in mainstream disciplines. In economics, this is highlighted by the fact that the classification of the economics literature by the *Journal of Economic Literature* has no specific category for animal health economics. Furthermore,

articles in journals on health economics focus almost exclusively on human health. Animal health economics also seems to have a marginal status in relation to veterinary studies and animal science. If a scientific journal could be established for animal health economics, it would help to advance its coverage and add to scientific recognition of the subject.

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Appendix

Power Point Slides to Accompany this Paper

Animal Health Economics. What Can It Do? What Are The Big Questions?

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Coverage

1. Introduction
2. Types of Animals to which Animal Health Economics is Applicable
3. A Variety of Economic Objectives are Relevant to the Economic Assessment of Animal Health
4. The Breadth of Economic Factors that Need to be Taken into Account in Animal Health



Coverage (cont.)

5. Important Dimensions in the Analysis of Animal Health Economics

- *Spatial dimensions*
- *The time dimension*
- *Stakeholders to be included*
- *Pathways and cycles involved in ill health in animals*
- *Risk and uncertainty*

Coverage (cont.)

6. The Economics of Knowledge – Information Economics and Research Development

- *Information economics and animal health*
- *Research and development*

7. Big Questions for Animal Health Economics

- *Public economics and finance questions*
- *The economics of precaution*

8. Concluding Comments

1. Introduction

- Considerable progress has been made in the analysis of animal health economics.
- Rushton (2009) provides an excellent overview of the current state of this subject.
- Despite this progress, many topics to which animal health economics could be applied are not yet covered.

2. Types of Animals to which Animal Health Economics is Applicable

- The main focus of animal health economics has been on livestock, particularly livestock used commercially.
- Animals, such as fish, used in aquaculture have received less attention.
- The economics of maintaining the health of pets, animals kept as a hobby, and so on has received virtually no attention.

Types of Animals to which Animal Health Economics is Applicable (cont.)

- The health of wildlife has been assessed primarily in terms of its economic impact on the livestock industry. The economic value of wildlife in itself and the value of it being kept healthy has been left out of the equation.
- The health of non-vertebrate animal species can be of economic interest but receives virtually no coverage.

3. A Variety of Economic Objectives are Relevant to the Economic Assessment of Animal Health

- Given the range of animals, the health of which is important, the economic objectives for maintaining animal health can vary a lot.
- Even in the case of commercial animals, health decisions are unlikely to depend just on expected profits. Considerations about economic security and liquidity can also be important.

A Variety of Economic Objectives are Relevant to the Economic Assessment of Animal Health (cont.)

- Household livestock producers may be much more risk-averse than business enterprises. This is one factor that may influence households to favour local breeds because of their greater disease-resistance. Businesses may be more receptive to adopting exotic breeds. Hence, dual livestock systems evolve in many developing countries.

. A Variety of Economic Objectives are Relevant to the Economic Assessment of Animal Health (cont.)

- Motives for keeping companion (and similar) animals healthy can be expected to differ from those applying to animals kept for commercial or subsistence purposes.
- Economic techniques (such as contingent valuation, choice modelling) have been developed to value wildlife. The economics of maintaining the health of wildlife needs further development.

4. The Breadth of Economic Factors that Need to be Taken into Account in Animal Health

- The main focus of animal health economics appears to have been on disease outbreaks.
- The following factors affecting the economics of animal health need more attention.
 - *Genetics*
 - *Environmental conditions*
 - *Nutrition*
 - *The comfort of animals*
 - *Institutional features of animal husbandry*

5. Important Dimensions in the Analysis of Animal Health Economics

- The following dimensions are discussed:
 - *Spatial dimensions*
 - *Time dimensions – two different aspects*
 - *Stakeholders to be included*
 - *Specification of pathways in ill health*
 - *Ways of allowing for risk and uncertainty*
- The results from the analysis of health economics depend very much on the dimensions taken into account in the analysis.

6. The Economics of Knowledge – Information Economics and Animal Health

- Information economics has a wide range of applications to animal health economics but this application is under researched.
- Areas to which it can be applied include the following:
 - *The amount of expenditure to make in monitoring (surveying) animals for ill health.*
 - *Diagnosis of the causes and occurrence of ill health.*
 - *Data collection and storage.*
 - *Transactions (exchange).*
 - *Specification of health implications on the basis of limited information.*

6. The Economics of Knowledge – Research and Development and Animal Health

- Reliance solely on market systems to provide research and development for maintaining animal health will result in some socially beneficial research and development being neglected. This is a result of market failures.
- A role for the public sector exists for filling these deficiencies.
- However, the public sector can suffer from political failures and public research bodies can 'lose direction'.

7. Big Questions for Animal Health Economics

- What should be the role of the public sector in maintaining animal health and how should it finance its involvement?
- What precautions are likely to be economic in relation to animal health?

8. Concluding Comments

- Despite progress with animal health economics it is still underdeveloped.
- Reasons for this might include the following:
 - *Much public funding for research on animal health economics is in reaction to short-term crises, such as major outbreaks of disease.*
 - *The transdisciplinary nature of the subject may deter some researchers from focusing on it.*
 - *The subject appears to be treated as peripheral to mainstream subjects such as economics, veterinary studies, animal science and health economics.*
 - *If a scientific journal for animal health economics were to be established, it would facilitate the development of this subject.*

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