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Economic aspects of foot and mouth disease in Bolivia

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Summary
The paper presents results from two economic analyses of foot and mouth disease (FMD) in Bolivia. Both recommended a programme to eradicate the disease, but one reported a negative economic return while the later study found a positive and robust return. To investigate the reasons for these differences the paper presents information on cattle movement and how this relates to the epidemiological situation of FMD in Bolivia. This analysis identifies two important trade routes: southern and central cattle trade routes and two FMD endemic areas: the humid tropical areas of the Departments of the Beni and Santa Cruz, and the semi-arid subtropical area to the south east of the country known as the Bolivian Chaco. The farm-level incentives to control FMD in the endemic areas, where cattle are kept in extensive systems, are negative and the main losses caused by the disease occur four to six years after an outbreak. Given this situation it is suggested that resources being used to eradicate the disease in Bolivia should be concentrated in these endemic areas where convincing cattle owners of the need to control FMD is particularly difficult. It is also suggested that the eradication programme should coordinate its activities with neighbouring countries.

Keywords
Cattle movements – Economics – Epidemiology – Farm-level incentives for control – Foot and mouth disease.

Introduction

Eight years ago Bolivia began an eradication campaign for foot and mouth disease (FMD) under its new Agricultural Service SENASAG (Servicio Nacional de Sanidad Agropecuaria e Inocuidad Alimentaria). An ex ante assessment of this campaign strategy was carried out during the late 1990s by a team from the Pan American Health Organization (PAHO) and the Inter-American Institute for Cooperation on Agriculture (IICA) (15). A previous study was carried out in 1995 by a team from the Food and Agriculture Organization of the United Nations (FAO) and the Department for International Development (DFID) of the United Kingdom (UK) (4). This paper will present the:

– principal findings from those two studies, including comments using information made available by data collection and surveillance activities in the late 1990s

– movement of cattle within Bolivia and its relationship to FMD epidemiology

– impact of FMD and its control in the extensive beef systems in the tropical lowlands of the country, where FMD is believed to be endemic (15).

Economic assessments of the control of foot and mouth disease in Bolivia

1995 – Study undertaken by the Food and Agriculture Organization of the United Nations and the Department for International Development of the United Kingdom

In 1995, an FAO/DFID consultancy team comprising a team leader, an epidemiologist, a specialist in animal production, a livestock economist and a sociologist carried out an evaluation of the control and eradication of FMD in Bolivia (4).

The team found that the livestock sector was relatively weak, with poor infrastructure in terms of marketing and transport of animals and very little support in terms of extension and banking. The consultants stated that the husbandry levels were low in terms of management and input use, leading to poor profitability. Recent analysis by Hoyos (7) suggests that this rather gloomy picture of the livestock sector is not that accurate. Hoyos found that the liberalisation of beef prices and the removal of restrictions on private companies being involved in the slaughter of cattle in 1985 has gradually encouraged private investment in slaughterhouses and in the marketing of animals and meat (7). One slaughterhouse in Santa Cruz now has a contract with McDonald's, exports small quantities of specialist beef cuts to Peru and is close to meeting the regulations of the European Union and the United States Department of Agriculture (9). In addition, Hoyos reports that there have been improvements in cattle management and breeding (7). These changes in the livestock sector were occurring during the consultancy by FAO/DFID, but the investments have been relatively slow because of the long-term nature of the cattle business and because investors required time to have confidence that the liberalisation policies would not be reversed.

The FAO/DFID team believed that Bolivia would produce a surplus of beef in the near future and required an export policy to improve weak infrastructure for the export of meat. However, recent studies would indicate that Bolivia has a limited capacity to export beef due to a growing urban demand (13) and a limited ability to supply beef (12).

With regard to FMD, FAO (4) concluded that the disease was a constraint to large producers, but not to smallholder farmers. Information on FMD outbreaks after this consultancy would contradict this view. Between 1997 and 2000 the control of FMD was good in the smallholder producer areas of the country, but was poor in the extensive beef producing areas where the large cattle farmers have their ranches (see the next section). This would suggest that although these large producers state that FMD is important, their actions in terms of control are different.

The FAO (4) reported that FMD campaigns in the past had been ineffective and that the disease was endemic in most parts of the country due to a lack of public sector enforcement of FMD control. This epidemiological situation appears to have changed during the late 1990s, with only certain areas of Bolivia regularly reporting FMD outbreaks (information is provided in the next section).

On the basis of the information gathered, the FAO/DFID team detailed different alternatives for the control of FMD including a 'do nothing' policy. Of the strategies outlined, a plan of vaccination over ten years (including a financial and economic analysis of the plan over a 20-year period) was presented in detail. Their analysis produced a benefit–cost ratio of 0.42 and 0.6 for the financial and economic analysis respectively. Despite this poor return the authors of the report indicated that there were a number of important unquantifiable benefits from the control of the disease and that it was important to begin the programme initially with an information gathering project to provide better information about the disease.

1997 – Study undertaken by the Pan American Center for Foot and Mouth Disease

The FAO/DFID study was followed by a study by the Pan American Center for Foot and Mouth Disease (PANAFTOSA) (15). This study prepared an implementation plan for the control of FMD. The plan was based on an intensive vaccination campaign over a five-year period in the identified endemic areas, which were the Departments of the Beni and Santa Cruz and the ecological region known as the Chaco, which covers the eastern regions of the Departments of Santa Cruz, Chuquisaca and Tarija. The benefit–cost ratio of this plan was 1.38 using an 8% discount rate over a 20-year analysis period. In addition, the project was found to be robust enough to cope if there were a need to extend the vaccination campaign from five to ten years in the endemic areas of the Beni.

While it is difficult to compare the analyses of the two consultancies, it is important to consider why they produced such different results in terms of economic return to the eradication of FMD in Bolivia. One of the main reasons for the differences is believed to be a lack of reliable epidemiological information on FMD in Bolivia and also a lack of reliable information on the livestock sector in general. The following section will therefore provide information on cattle movement and FMD

epidemiology in Bolivia to help identify where the disease is endemic in the country. This information was generated during the information-gathering project that was recommended by FAO (4) and supported by the Bolivian and British governments (19).

Cattle movement in Bolivia and its relationship with the epidemiology of foot and mouth disease

There are various reports in the literature of the importance of livestock movement with regard to FMD epidemiology. Perry and Hedger (17) reported that FMD outbreaks in Zambia were associated with the movement of livestock along trade routes. Rweyemamu (24) found that the movement of cattle in West Africa from the Sahel to the population centres of the coast causes the rapid spread of FMD. More recently, the FMD epidemic in Taiwan was related to pig movement and pig markets (26) and the FMD epidemic in the UK was related to the market movement of sheep (5). Such movements are normally related to differentials in livestock and meat prices and therefore the epidemiology of FMD cannot be separated from the economics of livestock movement. This section will provide information gathered over a three-year period on cattle and meat marketing (12) and relate this to FMD epidemiology in Bolivia.

Two main cattle trade routes are identified in Bolivia:

– Southern trade route
– Central trade route.

There is also a very minor amount of trade between the northern Department of Pando and its neighbouring areas.

The southern trade route begins in the south-east part of the country which is called the southern Bolivian Chaco. The activity is centred on a town called Villamontes. Cattle move up from this zone to the city of Tarija to satisfy demand for meat in this city and provide male animals for traction power. Some of these male animals are also transported into the southern part of the Department of Chuquisaca (known as the Cintis) and to the valley zones of the Department of Potosi. This Department has an important market in a town called Belen, which has links with the markets in the Department of Oruro, Challapata and Caracollo (12). These Oruraña markets in turn have links to the market of Lahuachaca in the Department of La Paz and also the slaughterhouses in the cities of El Alto and La Paz (see Fig. 1).

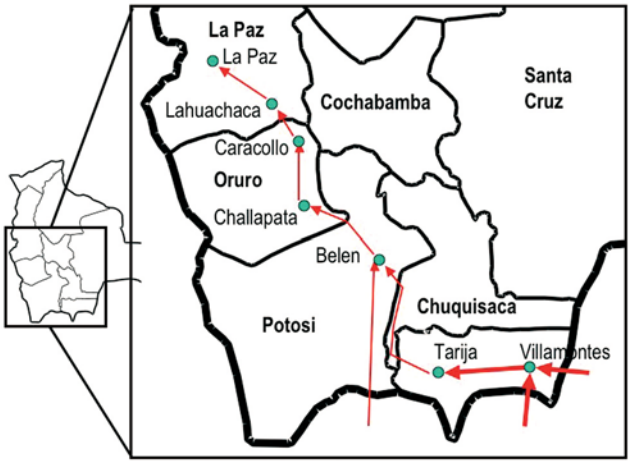

Fig. 1
Southern cattle trade route in Bolivia

The central trade route involves the movement of cattle from the tropical lowlands of the Departments of Santa Cruz and the Beni to the cities of Santa Cruz, Cochabamba and La Paz. This movement is related to the need to satisfy the demand for beef in these cities. The movement to the city of Santa Cruz is of live animals and to the cities of Cochabamba and to La Paz it is a mixture of meat and live animals. Within this trade route there is also a significant amount of movement of male animals from the Chaco region of the Department of Santa Cruz to satisfy the need for bullocks for traction power in the valley zone of Bolivia (27) (see Fig. 2).

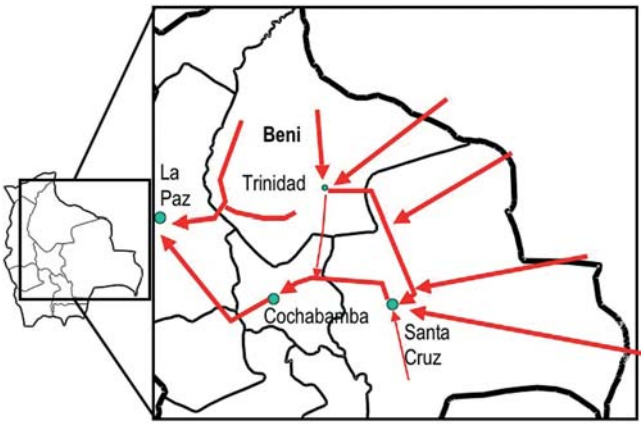

Fig. 2
Central cattle trade route in Bolivia

Within both trade routes different types of movement are identified:

– cattle being moved to a different location to be finished for slaughter

– finished cattle being sent to markets and then to slaughterhouses

– male animals being transported for use as bullocks for traction power

– finished cattle being moved directly to slaughterhouses

– chilled meat being sent to cities.

The first type of movement is seen mainly between the Departments of the Beni and Santa Cruz and also within the Department of Santa Cruz. In many cases this movement involves driving large herds of cattle by foot. It is noted that these large cattle movements may change now that a tarmac road has been completed between Trinidad and Santa Cruz. This in turn may change the FMD epidemiology in this area, where transport of cattle by truck will become feasible. The main movement of cattle to markets and then to slaughterhouses is seen in the country's largest weekly cattle market, Punata, in the Department of Cochabamba. This market has a mixture of animals for slaughter from different regions of the country, young male animals from other regions for traction power and local draught and dairy cattle. Each week there is an average of between 700 and 800 animals marketed in Punata (12). The movement of young male animals for draught power is seasonal and normally involves Criollo breed cattle rather than the Nelore and Zebu breeds that are found in the humid tropical zone. The movement of finished cattle direct to slaughterhouses is encountered in all the main cities in Bolivia, but is of greatest importance in Santa Cruz where between 500 and 600 cattle are slaughtered each day (12). Finally, chilled meat is transported between Santa Cruz and Cochabamba, Santa Cruz and La Paz and also the western zone of the Beni to the city of La Paz (12).

How does this cattle movement relate to the epidemiology of FMD in Bolivia? Despite the large amount of movement of cattle and meat, FMD appears to have been endemic only in the humid tropical regions of the Departments of Santa Cruz and the Beni between the years of 1997 and 2000 (see Table I). There were sporadic outbreaks in Cochabamba, Pando, Chuquisaca and La Paz. There were also outbreaks in Tarija but these were isolated in the Villamontes region of this Department. The La Paz outbreak was an isolated event in the city slaughterhouse and did not spread into livestock holdings (14). The outbreaks in Cochabamba were associated with cattle movement in the Punata market and were relatively quickly controlled by ring vaccination. The speed of this control is not really surprising given that the area close to Punata is one of the most important milkshed areas of the country (18) and that FMD has been known to cause dramatic losses in dairy farms in the zone (3).

The other Departments did not record outbreaks between 1997 and 2000 and it is concluded that the disease was absent in these regions and well controlled in every Department apart from the Beni and Santa Cruz.

Table I
Number of confirmed outbreaks of foot and mouth disease in Bolivia between 1997 and 2000 by Department

Department	Number of outbreaks			
	1997	1998	1999	2000
Santa Cruz	26	19	54	52
Beni	3	12	16	15
Cochabamba	4	0	2	2
Pando	0	1	1	2
Tarija	0	0	3	1
Chuquisaca	0	1	0	0
La Paz	0	0	1	0
Total	**33**	**34**	**77**	**72**

Source: MAGDR/UNIVEP (10, 11)

Sero-surveys that have been carried out between 1998 and 2001 support the view that large parts of Bolivia were free from FMD during the late 1990s (Table II). In some cases, the results indicate that FMD virus was not circulating in many areas of the country for some considerable time.

This very positive picture changed in 2001 when FMD in the Villamontes region was spread through the southern cattle route into the city of Tarija, the Cintis of Chuquisaca and into parts of the Department of Potosi (Guerra,

Table II
Results of serological tests in Bolivia between 1998 and 2001

Area tested (reference)	Year	Estimated population	Number of samples		Comments
			Taken	Positive*	
Department of Tarija (1)	1998	315,000-350,000	1,643	28	Area close to Villamontes suspected to have virus circulating Valley region thought to have been free for 10 years
Altiplano – the border region with Chile (25)	1998	10,000-20,000	487	0	
Tropical zone of Cochabamba (Chapare) (23)	2001	51,000**	1,250	2	Positive animals were from outside the zone
Los Cintis of Chuquisaca (22)	2001	80,000**	400	0	

* virus infection-associated antigen test
** population was unknown prior to the survey. These estimates were made using data collecting when blood sampling was taking place

personal communication). In the latter two cases the disease was quickly controlled by ring vaccination and movement control. On the central cattle route FMD in Cochabamba was spread into the Departments of Oruro and La Paz (Huallata, personal communication).

The changes seen in FMD epidemiology in 2001 are related to a shortage of vaccine in Bolivia in the early part of the year, which can be linked to the regional problems with FMD during this period. This restricted the ability of the Veterinary Services to control primary outbreaks and the movement through markets spread the disease into the Altiplano regions of the country. There also appears to have been a much more serious FMD epidemic in the area of Villamontes which probably began with the outbreaks reported in 1999. Whether this epidemic was self-maintaining or was amplified by movement of FMD-infected cattle from outside the zone is not known. However, given that the zone has to buy cattle to meet its commitments of satisfying beef demand in the city of Tarija (12), it is likely that cattle movement from outside the zone had an influence on the scale of this epidemic.

Despite these setbacks in the control of FMD in Bolivia in 2001, it appears that in general the risks of spreading FMD through the cattle trade routes are greatest within the Beni and Santa Cruz regions. The disease spreads from these endemic zones occasionally, but can be controlled with ring vaccination. The situation in the southern part of the country is more complicated in that it is very dependent on the FMD status of the southern Bolivian Chaco. Low levels of FMD viral activity do not seem to be sufficient to spread the disease into the valley and Altiplano regions in the southern part of the country. However, large outbreaks in the southern Bolivian Chaco do have the ability to spread the disease. The reasons for FMD epidemics in this part of the Chaco are largely unknown, but are probably related to cattle movement from other endemic areas.

From an economic point of view it appears that resources need to be concentrated on the endemic zones of Santa Cruz and the Beni to control and eradicate the disease in the country. This was also the conclusion of PANAFTOSA (15) and is also an important consideration for a country such as Bolivia, which has a growing urban demand for beef (13) and a limited ability to export meat (9, 12). An economic analysis by Pasang Tshering (16) in Bhutan, which also has limited ability to export beef, found that positive economic returns to FMD control could only be achieved when resources were concentrated in the endemic areas of that country.

The cattle in the endemic zones of Bolivia are predominantly found in extensive beef systems and it is therefore important to understand the incentives of controlling FMD at farm-level in these systems. Without this information it is difficult to plan incentives and controls for vaccination campaigns that will enable adequate vaccination coverage to be achieved. The following section will provide information on farm-level incentives for the control of FMD in the extensive beef systems.

The impact of foot and mouth disease when using different strategies of vaccination in the extensive beef systems of Bolivia

Between 70% and 80% of the cattle in Bolivia are found in the humid tropical lowlands of the departments of the Beni and Santa Cruz (18, 20). The management of cattle in these zones is extensive, with some cattle producers only seeing their cattle once or twice a year to brand animals and to select animals for sale (2). Although output per animal and per unit area of land is low the extensive system is well suited to the economic pressures of the area, where land is cheap and human population density is low, making labour one of the most scarce resources.

Within this management system FMD appears to be able to maintain itself and only causes sporadic problems to individual producers. These problems are not sufficiently great to stimulate serious attempts to eradicate FMD in the area. This conclusion is not new, but there does not appear to be any information in the formal literature which details the actual impact of FMD at farm-level in extensive beef systems. However, Rushton, Thornton and Otte (21) presented a methodology for examining the impact of different FMD vaccination strategies. This methodology was applied to the problems of controlling FMD in the extensive beef systems of Bolivia by Hoyos, Rushton and Angus (8). Hoyos *et al.* (8) found that the major losses due to FMD occur between three and four years after an outbreak and that to make it profitable to vaccinate a herd twice a year, a farm would have to suffer an outbreak every one to two years. Data on the FMD epidemiology in Bolivia in the endemic areas would suggest that the risks of an outbreak are more likely to be every 10 to 20 years.

To emphasise the results of Hoyos *et al.* (8) an economic analysis of an FMD outbreak at farm-level is presented here. The analysis is based on a dynamic deterministic model, which can take account of mortality, offtake and fertility parameters for a herd with and without disease. The model also allows the user to indicate the morbidity of the affected herd and the value of healthy and infected animals. No parameters were included for milk production as this is not an important output from extensive beef systems found in the humid tropics of Bolivia. The analysis period of the model is 10 years. The model output allows the user to examine the herd sizes, costs and returns of the herds with and without disease. The parameters used for the results of the model run presented are found in the annex of this paper (the impacts of the disease are based on

expert opinion and observations of impact in such herds during the late 1990s in Bolivia).

Figure 3 shows the projection of herd size for herds with and without FMD in the first year of the simulation. The original herd size is based on a herd with 100 cows. It was assumed that the herd without FMD vaccinates twice a year. During the first six years of the simulation there is a large difference in the herd sizes which is mainly related to the number of young stock in each herd.

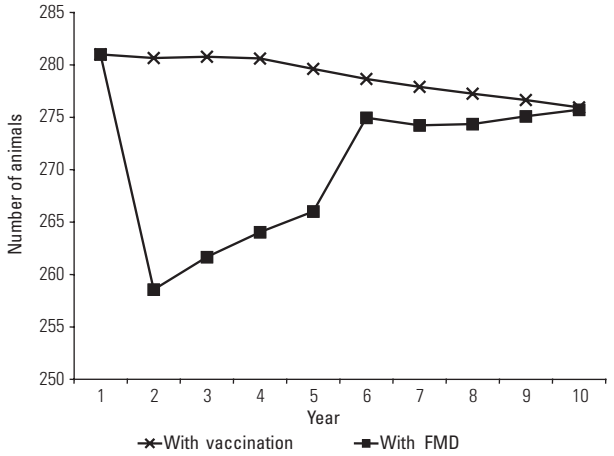

Fig. 3

Projections of herd size for a herd with vaccination against foot and mouth disease (i.e. no FMD) and a herd without vaccination and an outbreak of FMD in the first year of the simulation

Figure 4 shows the undiscounted costs associated with FMD control and the losses caused by the disease. The costs in the herd without FMD and practising twice-a-year vaccination are related to the herd size, but are relatively constant. In the herd that had an FMD outbreak in year 1 of the simulation the losses are similar to the costs of vaccination until years 4 to 6. The difference is greatest in year 5, which is approximately 4 years after the outbreak.

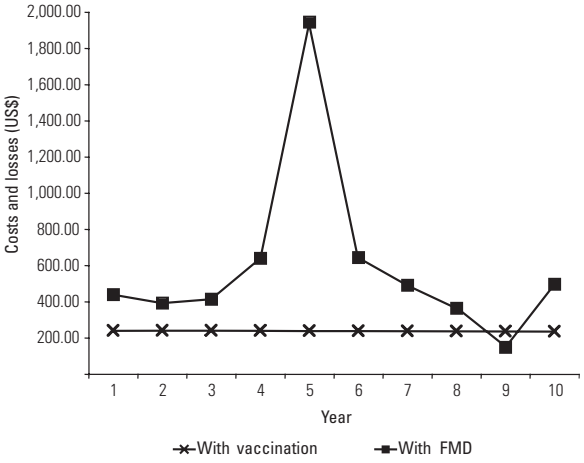

Fig. 4

Undiscounted costs and disease losses for a herd with vaccination and a herd without vaccination and an outbreak of FMD in the first year of the simulation (US$)

The reasons that losses are predicted to occur so long after the outbreak relate to the time that an animal is ready for sale in these extensive systems. Male animals are sold at between four and six years of age and female animals are normally all retained in the herd. An FMD outbreak in such a system has little effect on the male adult animals, but increases calf mortality and reduces fertility in cows and heifers. Therefore, in the year of the outbreak the calf crop is reduced and this is only felt as a loss when this calf crop matures for sale between four and six years after the outbreak. The nature of these losses is worrying in that it is unlikely that farmers will recognise the impact of FMD on the sale of their animals, as the major impact occurs so long after the outbreak. It would be natural for farmers to confuse a low number of animals for sale with other problems such as flooding or drought in the previous years.

Therefore, at farm-level the control of FMD in extensive beef systems does not give a positive economic return and the losses caused by an outbreak appear to be greatest some time after the outbreak. The results indicate that the cattle producers in the extensive rearing systems have been making rational decisions with regard to the control of FMD. Many are either not vaccinating or only vaccinating when they perceive an immediate risk. All these factors are considerable barriers to the successful eradication of FMD in the extensive beef systems of Bolivia and in other regions of Latin America. The analysis is limited in that it does not take into account the fact that with FMD eradication there would be no need for vaccination and that this would also allow the exportation of meat to more lucrative markets. However, to achieve eradication requires well-coordinated vaccination campaigns that reach high levels of coverage quickly. Poor vaccination campaigns would probably reduce the economic impact of the disease even more and reduce incentives to invest further in its eradication. This implies that the strategy of control and eradication of FMD in Bolivia should either be 'do nothing' or 'do everything well and quickly', i.e. there are no half measures. This rather practical conclusion is supported by theoretical assessment of disease control by Harrison, Tisdell and Ramsay (6).

Conclusions

During the 1990s two different evaluations of FMD eradication in Bolivia were carried out (4, 15). Both came to the conclusion that a programme to eradicate FMD was necessary in Bolivia, but the economic analyses were very different. The first study found that the economic returns were negative, whereas the later assessment predicted that the returns to FMD eradication were positive and robust. Whilst it is difficult to compare the two studies it is suggested that one of the reasons for the differences in the

economic analyses was the lack of reliable information on the livestock sector and the epidemiology of FMD in Bolivia. The current paper presents information generated in the late 1990s on cattle movement and FMD epidemiology which identifies the humid tropical zones of the Departments of Santa Cruz and the Beni (and also possibly the southern Bolivian Chaco) as being endemic. The FMD epidemiology in other parts of the country relate to the two important trade routes linking these endemic zones to the rest of Bolivia.

The southern trade route moves cattle from the southern Bolivian Chaco to the valleys of Tarija, Chuquisaca and Potosi and is also linked through weekly cattle markets to the Altiplano of Potosi, Oruro and La Paz. In recent years these areas have been free of FMD and have only seen it in the last year due to an FMD epidemic in the southern Chaco. The reasons for this epidemic are unclear, but seem to be related to movement of cattle to this zone from neighbouring endemic areas.

The central trade route moves cattle and meat from the humid tropical zones of Santa Cruz and the Beni to the cities of Santa Cruz, Cochabamba and La Paz. This movement has most risk of spreading the disease within the Department of Santa Cruz, the other Departments reporting sporadic outbreaks, which appear to be relatively easily controlled with ring vaccination.

These endemic zones were identified by the PANAFTOSA study, but no mention was made in their study of the farm-level incentives of controlling FMD in these zones, where the majority of the cattle are kept in extensive beef systems. An analysis by Hoyos *et al.* (8) found that the economic incentives for controlling FMD at farm-level with vaccination were negative and this paper reports that the main losses suffered due to an outbreak of FMD occur four to six years after the disease is present.

The information presented in this paper is of importance to the current FMD eradication campaign in Bolivia. It would appear that resources need to be concentrated in the endemic zones of the humid tropical areas of Santa Cruz and the Beni and in the southern Chaco. Vaccination campaigns in these areas need to be aware that farm-level incentives are low and that they can only be increased if the disease is eradicated quickly. In addition, it is important to note that these efforts to eradicate FMD from Bolivia need to be coordinated with neighbouring countries.

On a more general note, the paper shows that FMD epidemiology cannot be separated from economics (particularly the economics of cattle movement) and that economics of FMD control cannot be estimated without a sound basis of FMD epidemiology.

Acknowledgements

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Annex

Dynamic, deterministic model used to undertake an economic analysis of an outbreak of foot and mouth disease at farm-level

The model has the herd split into males and females with four age categories in each sex group

Type of animal	Number	Percentage
Female (< 1 year old)	25	9%
Female (1-2 years old)	22	8%
Female (2-3 years old)	21	7%
Female (3-4 years old)	20	7%
Cow	100	36%
Male (< 1 year old)	25	9%
Male (1-2 years old)	22	8%
Male (2-3 years old)	21	7%
Male (3-4 years old)	20	7%
Bull	5	2%
Total	**281**	**100%**

Standard parameters

Parameter	No vaccination (outbreak in the first year)	Two vaccinations
Herd size at the start of the simulation	281 (100 cows)	281 (100 cows)
Age at first calving	4 years	4 years
Fertility rate	50% in healthy animals	50%
	0% in the first year for sick animals	
Mortality rate		
0-1 years	14% for sick animals	9%
	9% for healthy animals	
1-2 years	5%	5%
2-3 years	5%	5%
Adult	5%	5%
Offtake rate (cows)	13% year 1 to 8	14%
	14% year 9 to 10	

Morbidity in year one as a percentage of the initial herd

Type of animal	No vaccination Year 1	Two vaccinations Year 1
Female (<1 year old)	100	0
Female (1-2 years old)	40	0
Female (2-3 years old)	40	0
Female (3-4 years old)	40	0
Cow	40	0
Male (<1 year old)	100	0
Male (1-2 years old)	40	0
Male (2-3 years old)	40	0
Male (3-4 years old)	40	0
Bull	40	0

Weights and prices of animals with and without foot and mouth disease

Type of animal	Without FMD		With FMD	
	US$	Weight (kg)	US$	Weight (kg)
Female (<1 year)	14.51	25	14.51	25
Female (1-2 year)	58.04	100	52.23	90
Female (2-3 year)	114.91	198	104.46	180
Female (3-4 year)	174.11	300	156.70	270
Cow	203.13	350	182.81	315
Male (<1 year)	15.63	25	15.63	25
Male (1-2 year)	75.00	120	65.63	105
Male (2-3 year)	143.75	230	130.00	208
Male (3-4 year)	218.75	350	196.88	315
Bull	281.25	450	253.13	405
Milk	0.38		0.38	

Costs of vaccination = US$0.65
Costs of treating a sick animal = US$0.45

La dimension économique de la fièvre aphteuse en Bolivie

J. Rushton

Résumé
L'auteur s'intéresse aux résultats de deux études consacrées aux aspects économiques de la fièvre aphteuse en Bolivie. Si les deux études proposent un programme d'éradication de la maladie, la première indique un retour sur investissement négatif tandis que la deuxième annonce une rentabilité effective et soutenue. Afin d'élucider les raisons de cette divergence, l'auteur examine les informations sur les déplacements de bétail et leur lien avec la situation épidémiologique de la fièvre aphteuse en Bolivie. Deux routes commerciales, l'une au Sud et l'autre au Centre, et deux zones d'endémie, l'une dans les zones tropicales et humides de Beni et de Santa Cruz et l'autre dans la région méridionale du Chaco bolivien, sont ainsi identifiées. Les incitations fournies au niveau des exploitations pour lutter contre la fièvre aphteuse dans les zones endémiques, caractérisées par un élevage de type extensif, s'avèrent contreproductives alors que les plus grosses pertes causées par la maladie n'interviennent que quatre à six ans après le foyer. Compte tenu de cette situation, il est suggéré que les ressources destinées à l'éradication de la fièvre aphteuse en Bolivie se concentrent sur ces zones d'endémie, où il est très difficile de faire accepter aux propriétaires de bétail la nécessité de lutter contre la fièvre aphteuse. L'auteur recommande également que le programme d'éradication coordonne ses activités avec les pays voisins.

Mots-clés
Bolivie – Déplacement de bétail – Économie – Épidémiologie – Fièvre aphteuse – Incitation au niveau des élevages.

Aspectos económicos de la fiebre aftosa en Bolivia

J. Rushton

Resumen
El autor presenta los resultados de dos análisis económicos de la fiebre aftosa en Bolivia. En ambos casos se recomendaba un programa para erradicar la enfermedad, pero en el primero se da cuenta de una rentabilidad negativa mientras que en el estudio más reciente se observó un elevado rendimiento positivo. Para investigar los motivos de tales diferencias, el autor presenta información sobre los desplazamientos de ganado y la relación que guardan con la situación epidemiológica de la fiebre aftosa en Bolivia. En este análisis se identifican dos importantes rutas ganaderas comerciales (la meridional y la central) y dos áreas donde la fiebre aftosa es endémica (Beni y Santa Cruz, por un lado, y el sur del Chaco boliviano, por el otro). Los incentivos a las explotaciones para controlar la enfermedad en las zonas de endemismo, donde la ganadería es extensiva, son negativos, y las mayores pérdidas causadas por la enfermedad se registran entre cuatro y seis años después de un brote. En vista de la situación, el autor propone que los recursos utilizados para erradicar la fiebre aftosa en Bolivia se concentren en esas zonas de endemismo, donde

resulta muy difícil convencer a los propietarios ganaderos de la necesidad de combatir la enfermedad. Además, propone coordinar con los países vecinos las actividades del programa de erradicación.

Palabras clave
Desplazamientos de ganado – Economía – Epidemiología – Fiebre aftosa – Incentivos a las explotaciones con fines de control.

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