Costs and benefits of foot and mouth disease control for global food security

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Summary

In developed countries as well as in developing, meat-exporting countries, foot and mouth disease (FMD) results in enormous losses. In developing, non-meat-exporting countries, and in particular low-income, food deficit (LIFD) countries, losses as a result of FMD are also important. However additional constraints impinge on livestock productivity. Furthermore, resource constraints and other animal health priorities compromise FMD control and eradication efforts. Productivity increases in livestock production are crucial for improving the food safety status in LIFD countries. Animal health programmes (including FMD control and eradication) have much to contribute. However, priority setting based on cost–benefit (C–B) considerations should guide decision making. Particularly in LIFD countries, 'scope economies' in the delivery of Veterinary Services may reduce costs and therefore increase the profitability of animal health (including FMD) projects.

Keywords: Agricultural development – Cost–benefit analysis – Food security – Livestock economics.

Introduction

Losses caused by foot and mouth disease (FMD) in developed economies have been estimated for both disease outbreaks that have occurred and those that could potentially occur. For example, in the case of the United Kingdom losses in the 2001 epidemic were estimated to be at least £3.1 billion (or US$5 billion) (12). For California, simulations of a possible epidemic result in costs ranging between US$8.5 billion and US$13.5 billion (4). These figures help put into perspective the enormous gap that exists between losses (actual or predicted) in developed economies, and the resources available in developing economies to improve control or even eradicate FMD. For example, in Latin America preliminary estimates of the *total resources* invested in Official Veterinary Services (OVS) are US$0.5 to US$1 per animal equivalent, or US$250 million to US$450 million for the region as a whole (7). In other words, the total allocation of resources to OVS in this region is less than 10% of the outbreak cost in the United Kingdom, or 5% of the predicted costs of an epidemic in California. These figures suggest the need for research aimed at answering the following questions:

– What are the incentives faced by developing countries in increasing resources allocated to FMD control/eradication?
– How are resources to be allocated between different animal health projects?
– Can FMD programmes be 'bundled' with other animal health efforts in order to increase effectiveness and reduce costs?
– Are there externalities associated with improved FMD control in developing countries?

This paper focuses attention on the issues encountered by developing countries in carrying out projects aimed at controlling and eventually eradicating FMD. An attempt is made to frame this problem in a wider, economic development perspective. In particular, linkages between FMD control/eradication and food security are explored. Food security issues refer to household access (via market transactions or self-production) to adequate nutritional levels. 'Food safety', on the other hand, revolves around the fact that even with 'adequate' nutrition, households may sometimes be exposed to health-reducing food-borne illnesses.

Food security

In developing countries the income-elasticity of demand for livestock products is greater than 1: meat demand increases faster than incomes (3). High income elasticity explains why per capita consumption of beef is approximately 6 kg/year in developing as opposed to 22 kg/year in developed countries (5). In the

case of dairy products, the per capita gap is even larger: 40 kg/year in developing versus 195 kg/year in developed economies (3).

The high income elasticity of demand for livestock products, coupled with the per capita income growth that has taken place in China and other Asian countries, suggests there will be large increases in the demand for animal products during the next decades. Indeed, research done by the International Food Policy Research Institute (IFPRI) forecasts that in 2020 total consumption of meat products in the developing world will exceed that of the developed economies. This is a dramatic change: in 1993 consumption in the developing countries was some 10% lower than in the developed counties (3). The projected increase in consumption in the developing countries (from 1993 to 2020) of some 105 million metric tonnes will have to be accompanied by production intensification: output per unit of land or output per unit of livestock will have to be increased substantially. Production intensification will have one important consequence: the cost–benefit (C–B) ratio of FMD control and eradication will increase, as impacts of FMD are positively associated with the livestock productivity of the affected herds.

The OVS of developing countries will face important challenges. The predicted increase of 20 million tonnes in beef and 45 million tonnes in pork production (from 1993 to 2020) implies a significant additional stock of animals to be controlled for diseases. A rough calculation results in some 230 million extra beef cattle and ten times as many pigs. The additional resources required by OVS are likely to be significant.

The last half-century witnessed important progress in the food security situation of some of the highly populated areas of the world. For example, per capita consumption increased from 2,000 calories to about 3,000 calories in China, and from 2,000 calories to 2,500 calories in India (10). To put these figures into perspective, minimum daily requirements are 2,100 calories per day (10). Despite these improvements, food prices are a major factor affecting the food security of low-income households. During the last five decades, food prices have shown changing patterns: from the early 1960s to the late 1990s (real) food prices halved (6). Since the late 1990s, however, food prices have increased substantially, peaking in 2008, when the price level of food rose 60% from the minimum reached during the previous decade. According to the Food and Agriculture Organization of the United Nations (FAO), by 2007, the number of undernourished individuals worldwide had increased to 923 million, up by 75 million from the 848 million in 2003–05. The Department of Agriculture of the United States of America (USDA) estimates, however, paint a grimmer picture: according to this source the number of undernourished increased in the same period by some 133 million. FAO predictions for the next decade result in prices somewhat lower than those prevailing in 2008, but considerably higher than average prices for 1998–2008. Food security therefore remains a serious challenge.

Rising food demand coupled with rising energy prices is an important factor explaining upward pressure on the price of food. According to USDA research (10):

– Calorie intake in sub-Saharan Africa is not much higher than daily requirements. This is the most food-insecure region in the world, with some 457 million undernourished people in 2007 (61% of the population). This region shows an increasing dependency on grain imports. Opportunities for increasing agricultural productivity exist but require additional resources.
– In Asia, the number of undernourished people is similar to that of sub-Saharan Africa. As a percentage of population, however, the situation in Asia is less severe than that of Africa: 24% of the population are undernourished in Asia, versus more than 60% in Africa.
– The situation in Latin America is less severe. However, exceptions exist: in the Dominican Republic, Nicaragua, Bolivia and (particularly) Haiti food security remains an issue for a segment of the population.

Productivity growth, FMD and food security

When analysing FMD impacts, veterinarians and other production-oriented scientists focus attention on output loss (abortions, growth or milk loss, mortality) resulting from a FMD outbreak. These are valid measures. However, in some cases it may be useful to cast the FMD problem in terms of the *impact of the disease on productivity growth*. The term 'productivity growth' includes not just production losses through mortality and morbidity, but aspects such as reduced incentives for investment in new inputs. The concept of *productivity growth* focuses attention on long-term impacts, as opposed to sporadic losses. Further, it emphasises the possible interactions between animal health and other production inputs.

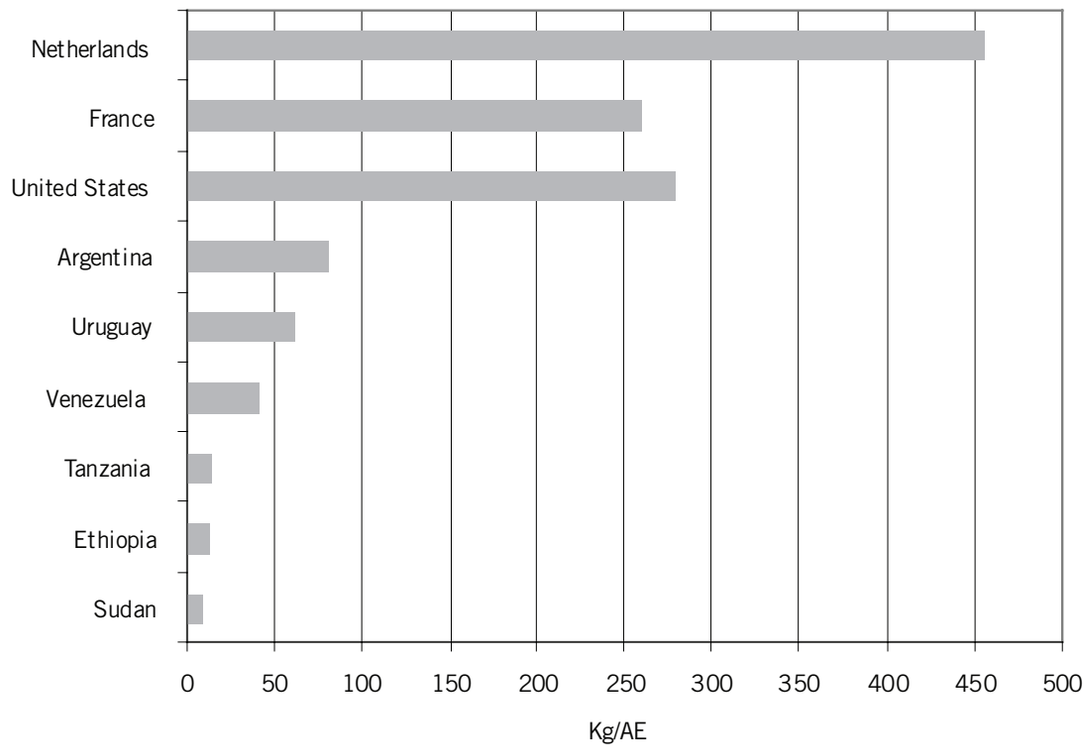

Figure 1 Production per animal equivalent

Data on livestock productivity growth are not abundant. However, Ludena and others (8) find important differences in total factor productivity (TFP) from 1961 to 2000 between regions: increases in (ruminant) TFP ranged from a high 2.87% in China to less than 1% in sub-Saharan Africa. Animal health is one of the several determinants of these productivity growth figures. It is very difficult, however, to disentangle the effects on productivity growth of animal health from the other production inputs. 'Poor' animal health practices will result in very different production impacts in a high-output California dairy herd than on smallholder milk production in north-east Brazil. Worldwide, enormous variation exists in output per animal-equivalent: for example (see Fig. 1) 450+ kg/AE-year in the Netherlands, 250 to 300 kg/AE-year in Canada and the USA, 60 to 80 kg/AE-year in Uruguay and Argentina, and less than 15 kg/AE-year in Tanzania, Ethiopia and Sudan. Clearly, the economics of animal disease (including FMD) control is radically different between these situations.

As an example of the above consider the following. In sub-Saharan Africa losses as a result of FMD are perceived as 'low' by pastoralists engaged in extensive livestock production (1). If these perceptions are correct, the benefits of FMD eradication may well be marginal (compared with costs). However, the benefits of improved FMD control will be substantially higher if livestock production systems include the use of new inputs, or higher levels of input use. As pointed out by Nobel prizewinning economist T.W. Schultz, the problem facing the agricultural sector of many developing countries revolves around discovering new ways of doing things – knowledge, and not necessarily costly projects, is the key to progress (11).

In relation to the above, a feedback loop exists: improved livestock productivity increases benefits of FMD control; in turn improved FMD control improves incentives to increase productivity. The impact of FMD control on food security will then depend on the extent to which this disease interacts with other technologies in increasing productivity growth. Efforts geared towards FMD control/eradication should therefore be viewed in the context of an overall livestock development policy. These policies require long-term efforts that in many cases cannot be sustained without foreign assistance.

The impact of FMD control and eradication programmes on food security differs according to whether the country participates (or can realistically participate) in FMD-free meat markets. Brazil, Uruguay and Paraguay are examples of this situation. In Brazil, for example, meat exports rose from less than 200,000 tonnes in the late 1990s to more than 1.4 million tonnes in 2006. In Uruguay during the same period, exports increased from 130,000 tonnes to more than 300,000 tonnes (5), while in Paraguay the increase

(from 1998 to 2008) was from US$120 million to more than US$740 million (13). Improved access to markets generates export revenues, thus reducing foreign exchange constraints. Economic development possibilities are increased, reducing poverty and therefore food insecurity. It should be pointed out, however, that improved access to FMD-free meat markets results in higher domestic meat prices. Although this can hurt consumers, overall producer benefits exceed consumer losses. Public policy measures (such as voucher or 'food stamp' programmes) may transfer part of the gains to low-income, food-insecure households.

Other countries are a long way off from participating fully in meat export markets. In these countries, productivity growth resulting from improved animal health (including FMD control and eradication) should put downward pressure on food prices. In turn, this will increase the real incomes of the poorest segments of the population. As an example of this situation, a recent study (2) of the Andean countries (Bolivia, Colombia, Ecuador and Peru) reported food expenditures (as a percent of income) of the poorest decile of the population ranging from 50% to more than 70% (maximum 73% in Colombia). These findings imply that a 10% reduction in food prices would result in an increase in real income of 7%. Increased domestic food production (including that of livestock products) is therefore of the greatest importance.

Exploiting economies of scope for FMD control in developing countries

There remains a significant FMD problem in low-income, food deficit (LIFD) countries. The African continent and South and Southeast Asia are geographical areas where extreme poverty is prevalent and where FMD outbreaks still occur. In Latin America, Ecuador and Venezuela also face significant levels of poverty as well as challenges from potential FMD outbreaks.

Resource constraints are particularly severe in countries where FMD is present. Allocation of public funds to animal health programmes should follow conventional C–B criteria: resources should be allocated to alternatives offering higher (marginal) returns. This concept can be applied to real-world problems. Figure 2 shows results from a study (9) attempting to rank the effects of animal disease on the poor. Results are derived from workshops attended by practitioners and experts, focusing, in particular, on the African continent and South and Southeast Asia. As shown, FMD ranks *third* as a disease affecting the most vulnerable segment of the population of these areas. Gastro-intestinal parasites and neonatal mortality have a higher ranking, while ecto-parasites rank only slightly lower. Rankings vary by ecosystem and by animal species. FMD, for example, is more important in mixed crop-livestock and peri-urban systems than in purely pastoral systems.

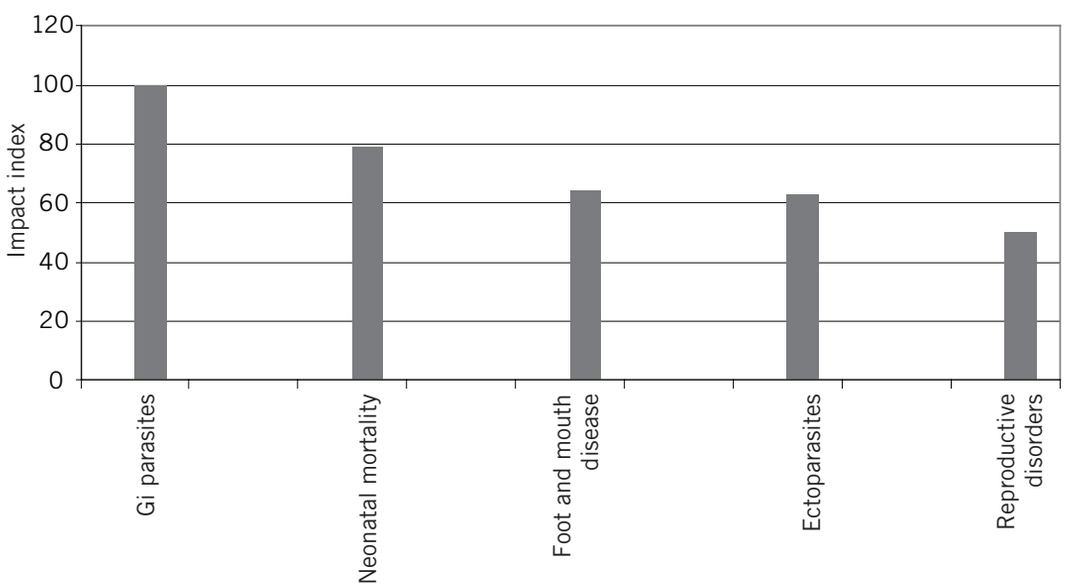

Figure 2 The impact of disease on the poor

The previous results suggest the following:

– Diseases differ in their relative importance, and this importance is contingent on a host of underlying factors;
– The importance of the disease is not the only factor governing resource allocation: a disease may be 'important' but effective control measures may not exist, or may be not effective from a benefit–cost perspective.

In LIFD countries progress in FMD control/eradication will probably depend on the extent to which economies of scope can be exploited among different animal health programmes. This concept refers to the possibility that costs of implementing *separately* a programme aimed at disease A and another at disease B may be greater than the cost of implementing a programme aimed at *both* A and B. These economies result from 'resource synergies' among programmes. As an example, in a LIFD country the incentive of smallholders to address FMD problems may be low; however incentives to address (say) gastro-intestinal parasites may be considerably higher. By 'bundling' both programmes into one, progress (and smallholder acceptance) may be improved (and costs reduced).

Conclusions

The economics of animal disease and in particular FMD control in developing non-exporting and in particular LIFD countries present challenges for researchers and policy makers. Returns to FMD programmes depend crucially on factors affecting livestock productivity: feed constraints, markets access and animal husbandry know-how. Decisions relating to FMD control are complex given the wide variation in production and market situations, and also given the fact that other animal health problems may present more pressing priorities for small livestock owners.

In LIFD countries, projects aimed at FMD can potentially be more successful if a holistic approach is employed, where FMD is one of the several constraints to be addressed. In particular, costs may be reduced and impact increased if scope economies between different animal health programmes are taken into account. Although an approach based on these concepts might help, LIFD countries will most probably require international assistance for progress to be made in relation to FMD. This assistance will benefit the international community, if worldwide threats of FMD spread are reduced. Positive externalities possibly result from reduced FMD outbreaks in developing economies. The Performance, Vision and Strategy (PVS) and Gap Analysis projects carried out by the World Organisation for Animal Health (OIE) are two examples of programmes that can help LIFD countries improve their Veterinary Services. In relation to these and other initiatives, it seems clear that in the near future multidisciplinary cooperation between veterinarians, economists, epidemiologists and other professionals will be increasingly occur. This is a welcome trend.

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