

The 2001 Foot and Mouth Outbreak: Economic Arguments against an Extended Cull

Peter Midmore[†]

1. Introduction

- 1.1. The Minister of Agriculture, Fisheries and Food announced, on 15 March, stringent additional measures to counter the spread of the current foot and mouth disease (FMD) outbreak. These involve a concentration of effort in the areas where clusters of the disease exist: specifically, a cull of all sheep and pigs within a 3-kilometre radius of each outbreak in Cumbria, Dumfries and Galloway, Tyne and Wear, and County Durham; a similar cull of all sheep that have come into contact with animals sold through Welshpool, Northampton and Longtown marts after 19 February, or through two dealers known to have come into contact with infected animals; more intensive monitoring in Devon; and a voluntary disposal scheme for sheep flocks stranded at tack far from their main holding, where their movement would incur a high risk of spreading infection and their welfare is jeopardised. Most recently, on the 24 March, the intention to cull sheep and pigs within a 3-kilometre radius of all outbreaks has been announced.
- 1.2. It is the intention of this briefing paper to demonstrate that, whether or not these measures bring the outbreak under control, their cost would exceed the main benefit secured from not adopting the alternative strategy of vaccination. The argument, by the government and the main farming unions, has been that because vaccination currently makes it impossible to distinguish between healthy and infected animals, the UK would lose disease-free status, and exports of livestock or livestock products to third countries could legitimately be banned under the phytosanitary conditions of the 1993 GATT agreement. However, to a large extent, the main exports in question are to the 14 other members of the EU; exports of cattle, sheep and pig-based products from the UK outside the EU are negligible.
- 1.3. On one hand, loss of export markets implies a loss of revenue, although the precise extent depends on how far animals and animal products otherwise destined for overseas markets would depress domestic prices. There is also the cost of prophylactic vaccination of farm animals prone to the disease. On the other, the extended cull contemplated in the 24 March announcement will require compensation for the livestock destroyed and costs of disposal, consequential losses for slaughter farms due to loss of sales and other outputs during the quarantine period; consequential losses for hauliers, processors, and other multiplier impacts; and effects on tourism.

[†] Peter Midmore is a professor at the Institute of Rural Studies, the University of Wales, Aberystwyth. A short biography appears at the end of this briefing paper.

2. The value of exports

2.1. Livestock-based exports from the United Kingdom to the other 14 member states of the EU are recorded by MAFF¹ on the basis of their primary agricultural commodity content. Table 1 below provides details of volumes on the basis of provisional figures for the year 2000; confirmed figures for 1999 are given for comparison.

	2000 (provisional)			1999		
	Exports ('000 tonnes*)	% of output	Farm gate value (£m)	Exports ('000 tonnes*)	% of output	Farm gate value (£m)
Cattle and calves (carcase weight)	9	1.3%	25.6	10	1.5%	30.3
Sheep and lambs (carcase weight)	124	31.8%	249.8	153	38.0%	380.0
Pigs and pigmeat (carcase weight)	9	4.2%	34.9	6	2.6%	20.3
Poultry and poultrymeat (carcase weight)	98	6.5%	84.1	105	6.9%	87.8
Milk	423	3.0%	69.2	465	3.2%	82.4
Butter	43	32.1%	14.7	50	35.5%	18.6
Cheese	47	13.7%	69.7	48	13.0%	77.8
Hen eggs	14	1.9%	6.9	15	2.0%	6.9

Source: MAFF
* Except Milk (million litres) and Hen eggs (million dozen)

2.2. The major export commodities, in terms of volume, are sheepmeat and dairy products. Provided that adequate precautions are taken, exports of dairy products, poultrymeat and eggs present minimal risk of spreading disease; in the case of dairy products, also, there is an emerging shortage of milk in the United Kingdom as farms have increasingly switched out of dairying, so the need for exports may change rapidly in the near future. Similar arguments apply to cooked meat products, although the overwhelming majority of livestock-based exports involving risk are either of meat or live animals.

2.3. The overall value of these exports at farm gate prices can be estimated, from the values provided by MAFF, as £550 million in the year 2000 (705 million in 1999). However, the exports affected would be only in the top three categories, valued in 2000 at £310 million (£430 million in 1999). Since, as noted above, the majority of the exports are either on the hook or (mostly) on the hoof, there is little additional economic output apart from transport costs; the marginal additional value of these would probably be negligible, as they only represent onward costs from market destinations outside the UK. Therefore, the £310 million probably represents a reasonable order of magnitude estimate of the overall value of threatened exports.

2.4. Nonetheless, as noted above, not all of the export revenues accruing to farmers would be lost, as the output would have some value on the domestic market. The question is to what extent such additions to domestic supply would depress prices. Red meats, like most foods, are price inelastic (that is, as prices fall, the amount purchased does not increase proportionately, and thus revenue from the product as a whole decreases). Between 1999 and

¹ MAFF statistics website, www.maff.gov/esg; all subsequent references to MAFF statistics are derived from this source.

2000, production, exports and imports of sheepmeat all fell, although domestic availability increased, by 11 thousand tonnes or 2.8%, because the import decline outweighed the other two changes. Yet the average farm gate of finished sheep in Great Britain rose from 180 to 196 pence per kilo carcase weight, an increase of nearly 9%; the price increase of store sheep was, proportionately, even larger, from £28.60 to £34.50 per head. Clearly, diversion of approaching some 125 thousand tonnes from exports should have a significant downward impact on domestic price levels, although if trends in the decline of the breeding flock and imports continue, the additional output requiring absorption could be as little as 100 thousand tonnes. The maximum reduction of revenue from loss of sheepmeat exports would be £245 million, although it could be substantially lower. Similar arguments apply to cattle and pig production, although volumes and values of exports are minor, in comparison to sheepmeat. Their inclusion could place a ceiling on potential loss of £300 million.

- 2.5. The cost of vaccination is difficult to estimate, but given the volumes of production involved, might be at most £15 million. It may be anticipated that, at volumes produced sufficient to vaccinate the entire susceptible farm animal population, unit costs would be very small. However, it may be possible for this cost to be borne by the EU agriculture budget, in order to safeguard animals elsewhere. Thus, in total, the maximum cost of the vaccination alternative would be limited to £315 million.

3. *The extent and cost of the extended cull*

- 3.1. The cost of the extended cull depends critically on estimates of the numbers to be slaughtered. Various assessments have appeared in the media; for example, the Scottish Executive have suggested that the numbers of sheep involved in the extended cull in Dumfries and Galloway would be 200,000, and in the same report an unidentified agricultural economist suggested that the overall total would be significantly higher;² more recently, the National Farmers' Union has suggested that the overall total number of animals involved might exceed 1,000,000, although the governments' Chief Veterinary Officer responded with a lower estimate of 300,000 animals.³ Clearly, the basis on which such educated guesses are made will vary, and are also likely to be influenced by political considerations. This section makes a transparent and realistic appraisal, based on the probable magnitude of the cull envisaged.
- 3.2. The most recent announcement (23 March) that the number of farms involved may exceed 4,000, and involve 31 million animals, clearly exceeds these estimates.⁴ As all animals within 3 kilometres of an outbreak are now to be regarded as dangerous contacts and slaughtered, the numbers of animals involved is likely to be substantially more than the original predictions, but a transparent and systematic approach is necessary.

² *Financial Times*, 15 March 2001.

³ *Financial Times*, 16 March 2001.

⁴ Professor David King, quoted in the *Financial Times*, 23 March 2001.

3.3. The estimation procedure for the likely numbers of animal to be culled in is as follows. An average density of total pigs and sheep per square kilometre is calculated from the 1999 county returns of the agricultural census, with an allowance for typical non-agricultural land uses within the 3-kilometre radius of outbreaks (as of 23 March).⁵ These densities can then be used to estimate the numbers of animals within the 28 square kilometre area within the 3 kilometre radius, although there will be a considerable degree of overlap between some cases, accounted for by a reduction depending on the distribution of cases within each county area (only counties with significant outbreaks so far have been assessed⁶). From this total, the cull of animals involved in existing cases needs to be deducted, leaving the final estimates as shown in Table 2.

	Pigs	Sheep
Cumbria	2,400	1,134,200
Dumfries & Galloway	3,700	342,600
Devon	25,800	177,600
Co Durham	14,500	205,800
Gloucestershire	8,700	43,600
Powys	1,500	308,000
Staffordshire	11,800	22,200
Anglesey	600	5,500
Tyne & Wear	2,800	9,500
Worcestershire	19,500	64,200
Essex	7,600	1,800
Herefordshire	6,200	78,600
Other counties	60,300	212,000
Total	165,400	2,605,600

3.4. The next step in this calculation is to take into account the numbers of animals having any contact with animals passing through the three marts and the two dealerships. A detailed estimate prepared for a related study (Institute of Rural Studies, 2001) suggests that 170,000 sheep could be linked in this way to sales in Welshpool Mart after 19 February. Sales through the other two marts are unlikely to be on such a scale, although taken together with sales through dealerships, a conservative hypothesis of the total number of animals involved might extend to 255,000 sheep.

3.5. In total, therefore, estimates of numbers of livestock involved in the extended cull are 165,400 pigs and 2,860,600 sheep. The economic losses involved in the cull relate, firstly, to the cost of compensation; secondly, to the consequential losses to both farming and the rest of the agri-food chain. Assuming that 10% of total pigs and 70% of total sheep are also breeding stock, and applying representative compensation amounts, the direct cost of the measures would amount to £72 million.⁷ With the average number of

⁵ Reported in the MAFF FMD website, <http://www.maff.gov.uk/animalh/diseases/fmd>.

⁶ That is, Cumbria, Dumfries & Galloway, Devon, Co Durham, Gloucestershire, Powys, Staffordshire, Anglesey, Tyne & Wear, Worcestershire, Essex, Herefordshire, Lancashire, Derbyshire and Wiltshire.

⁷ Compensation values applied are £100 for a breeding sow and £10 for other pigs; £30 for a breeding ewe and £10 for other sheep.

1,200 animals slaughtered per holding (calculated from outbreaks so far), a conservative estimate of the cost of disposal by burning would amount to over £2 million.⁸

- 3.6. Consequential losses on farms reflect the fact that compensation covers replacement costs of livestock only, although as the animals being culled can only be replaced by young breeding stock, and the extended cull itself will severely restrict their availability, actual expenditure could well be higher than compensation. Equally, if animals are being culled on the basis of the likelihood of FMD then the 6-month farm quarantine period should logically also apply (particularly since in the 1967 outbreak there were sporadic cases for five months after the main outbreak, which only lasted just over 12 weeks). For dairy and suckler cows, these losses cover the six-month period, although for sheep the entire year's production would be lost. Taking into account gross margin over feed cost only (from ADAS figures),⁹ these additional consequential losses amount, on the basis of the same reasoning applied in the previous paragraph, to a further £84 million.
- 3.7. The most convenient way of measuring the upstream and downstream linkages which govern the consequential losses of sectors allied to agriculture involves use of input-output models, or developments of them such as social accounting matrices or computerised general equilibrium models. The basic input-output model measures the relationship between changes in output, income and employment in one industry on the rest of the economy. Social accounting matrix approaches allow the effects of changes in income to be reflected in overall changes in demand; computerised general equilibrium models also take into account further price feedback effects, caused by changes in output. Early work on agriculture's relations with the overall economy (Midmore, 1993; updated in Midmore *et al.*, 1998) suggest that the overall regional income multiplier effect of changes in sheep output is around 1.29 (i.e. for each £1 change in sheep incomes, an additional change in incomes in all other sectors amounts to 29 pence. Analysis by Roberts (1995) shows that basic input-output multipliers are raised to some extent, if the additional impact of raised incomes on demand, subsequently raising output and therefore incomes further, is taken into account. However, the further effect identified by computerised general equilibrium models operates in the opposite direction, as changes in supply affect prices (McDonald and Roberts, 1998); thus, if output contracts, prices will rise to partially compensate for reduced incomes. These two effects could together raise multipliers in the sheep sector by 1.5%. Applying these multipliers to farm income losses identified above adds, approximately, a further £25 million.
- 3.8. Together, the impacts on the food supply chain and more widely on the aggregate economy amount, on the most conservative estimates, to £183 million. However, as amply demonstrated by this latest of misfortunes to

⁸ This assumes 4 day's labour at £100 per day, and materials and transport of £600 per outbreak, with average numbers of 1,200 animals to be cremated.

⁹ These gross margins are £45 per lowland sheep and £35 per hill sheep (for the entire production year). Since pig production is currently so unprofitable, no monetary loss of output is implied.

disrupt the rural economy, the effect on tourism has also been substantial, and the next section discusses this topic in more detail.

4. *The effect of an extended cull on tourism*

4.1. The various tourism authorities in the United Kingdom have estimated the overall cost of lack of access to the countryside, currently, as approximately £270 million a week, although if restrictions on access continue through April, that figure would rise to £410 million a week.¹⁰ Ostensibly an extended cull, if successful, would bring these losses to a more rapid conclusion; however, the argument of this section is that, particularly in the areas affected by the extended cull, more drastic action is likely to prolong the downturn in rural tourist activity. Although local tourism companies and government ministers are keen to emphasise that “the countryside is open for business”, no real impact is being felt on the staying away by the public. This is because three key attractions for visitors to rural areas, the sense of space, naturalness, and the quality of community (Bramwell, 1994) are all diminished by current difficulties. It may be presumed that both the impact of widespread loss of livestock and psychological impact of much wider culling would reinforce consumer perceptions about the desirability of rural tourism destinations, sufficient to jeopardise the entire annual season.

4.2. Cumbria and Northumberland each have about 2%, and Devon has about 5% of the share of tourism overnights in the UK,¹¹ although there are important non-rural visitor destinations in both regions. However, a recent Welsh study (Newidiem, 1999) calculated the rural share of Welsh total tourism expenditure at approximately 50%; since Cumbria, Northumberland and Devon resemble Wales to an extent in landscape and farming patterns, it may be reasonable to assume similar proportions. That would imply a current loss of about £11 million overall weekly, which would rise to £18 million weekly over the important Easter period, and perhaps fall back to the lower level in the early summer. Taking the season as a whole, a conservative estimate suggests that sustained losses of this nature would cost £640 million, just in the three regions with the highest concentration of outbreaks. Although a vaccination programme would in all likelihood come too late to prevent loss of the Easter trade, if successful it could minimise the effect on the summer season. The balance of savings would then be £480 million.

4.3. It is doubtful that the same argument could be applied either to Wales, where the overall impact would be more diffuse, or Dumfries and Galloway, where tourism activity is much less prominent than that south of the border. However, there would be some impact: the estimates prepared for Wales (Institute of Rural Studies, 2001) suggest that rural tourism losses are currently approximately £6 million a week; they would rise to £15 million weekly in April, £19 million in May, and £26 million, £43 million and £20 million in July, August and September respectively. Even if the affect on perceptions of a large-scale cull caused a quarter of those losses, the total for

¹⁰ *Financial Times*, 14 March 2001. In England and Scotland, this assumes a 20% decline in rural tourism activity; in Wales, a larger 75% decline is estimated.

¹¹ STAR UK tourism statistics website, www.staruk.org.uk.

the season would be £120 million. Neglecting the impact entirely in Dumfries and Galloway, the overall impact on tourism can be conservatively estimated at £600 million.

5. *The overall perspective*

5.1. The aim of this final section is to assess the validity and strength of the various elements of the argument presented so far, which overall suggests that costs exceed the benefits of the extended cull by £82 million. The summary account is presented in Table 3; the section goes on to evaluate the accuracy of the various components of calculations, before finally commenting on the overall legitimacy of this conclusion.

<i>Benefits</i>		<i>Costs</i>	
Maintain exports	300	Direct compensation and disposal costs	72
Avoid vaccination costs	15	Consequential loss: farms	84
		Consequential loss: rest of the economy	25
		Loss of tourism revenue	600
Total	315	Total	781

5.2. The quality of the estimate of the value of export sales to the farm economy depends on the use of average farmgate prices. It may well be the case that exports are of a different grade, and therefore possibly higher price, than farmgate prices imply. For example, exports of pigs and pigmeat are likely to contain a high proportion of breeding stock, which are of considerably higher value than meat; but as most such production is located in currently disease-free areas, they could be protected by an agreement to zone the UK for disease susceptibility. However, the bulk of the exports are of sheepmeat, predominantly to Mediterranean countries which prefer a light lamb, and for which significantly better returns can be made than in the domestic market. Thus the ceiling on the impact of gains to the economy from exports may be correct, although if the output had to be diverted to the domestic market then the actual loss may be somewhat closer to the ceiling. A generous, and possibly unneeded, cost of vaccination has been estimated.

5.3. The validity of both the cost of direct compensation and consequential farm losses of output depend on the accuracy of prior estimates of, firstly, the numbers of animals involved in the cull, and secondly, on the appropriateness of the values chosen for each component; whereas the consequential loss incurred by the rest of the economy depends directly on the preceding estimates. The calculation of numbers affected depends on how well the average densities reflect the actual animal populations within the 3 kilometre radii surrounding infected farms. With the large number of cases involved, it is unlikely that all have densities less than the average; however, even if they were, it should be pointed out that any holding with land within 3 kilometres of an outbreak is affected, with the possibility that far greater areas of land than implied in the calculation in Table 2 may be involved. Therefore this estimate may be considered highly conservative. The estimates of animals

affected by contact with the three marts thought to be focal points of infection may be inflated if the holdings that purchased animals are below average in size and stocking density for the mart catchment areas; because of the numbers involved, this is statistically unlikely. Also relying on probability, the division between breeding and other stock is based on average farming practice, and it is possible, although unlikely, that there is a greater proportion of young stock and followers in the farms affected. The values for both compensation and consequential losses on farms are deliberately prudent. Finally, inter-industry multipliers are known to be underestimates where contractions are involved, and overestimates in the case of an expansion (Midmore, 1993); however, it is also the case that multipliers tend to decline in value over time, and as those used here are now somewhat dated, the underestimation can be considered to be offset by the latter phenomenon.

- 5.4. The estimates of weekly tourism losses are based on well-identified patterns of seasonal activity, together with tourist organisations estimates of the average decline in occupancy and bookings. In some cases, rural tourism activity is completely absent, as all rural National Trust properties and Youth Hostels, for example, are closed. Nevertheless, the general impression being transmitted by the relevant tourist organisations is that activity is seriously depressed, and also failing to respond to suggestions that rural visits are still acceptable.
- 5.5. If the estimate of export revenues is not an overestimate, and additionally if the estimates of direct costs and consequential losses are not a conservative underestimate, then the case presented depends critically on the conjecture that an extended cull will reduce tourism by even more than has already transpired. Clearly, the vitality of the rural tourism sector depends importantly on visitors' perceptions of the quality of experiences to be appreciated; it is evident that these perceptions have been damaged from the scale of promotional activity being envisaged for the time when restrictions on access can be completely lifted. A cull on a significant additional scale, particularly when contemplated in such a highly public way, must affect the appeal of the areas that are most affected.
- 5.6. However, the case against an extended cull does not rest there. Both it and vaccination carry risks that the measures employed will be sufficient to control the spread of disease. Yet these risks are asymmetric: if, for example, the cull were ineffective, export markets would be lost but all of the other costs would still be incurred, a total loss to the economy (provided the reasoning above is valid) of £1,081 million; if vaccination is ineffective, it would nevertheless bring some protection to animals currently free of the disease, and probably allow a more discriminating cull in the medium term, with a total loss somewhere between £3150 and £781 million. There are also two further considerations favouring abandonment of the extended cull. Firstly, there is a suspicion that, as the incubation period in sheep is significantly less than 21 days, and the disease is less easy to diagnose, it may have been within the British sheep flock for some time. If that is the case, then there is no point in undertaking the extended cull: the export market will be lost for some time, and the (not at all insignificant) costs will be incurred

needlessly. Secondly, a scientific test enabling vaccinated sheep to be distinguished from those challenged by the disease is coming close to acceptance. That would enable the costs of a mass cull to be avoided, whilst still holding out hope for continued exports.

5.7. The reasoning and data on which the arguments in this briefing paper have been constructed are rudimentary, but the best that can be deployed at short notice. They could be considerably refined if further time were available, but currently represent the best available guess of the relative magnitudes involved in deciding on this complex issue.

References

- Bramwell, B (1994) Rural tourism and sustainable rural tourism, *Journal of Rural Tourism*, 2(1-2), 1-6.
- Institute of Rural Studies (2001) *The economic impact of Foot and Mouth Disease on the rural economy of Wales*, briefing paper prepared for the Welsh Development Agency, Aberystwyth: Institute of Rural Studies (The University of Wales).
- McDonald, S and Roberts, D (1998) The economy-wide effects of the BSE crisis: a CGE analysis, *Journal of Agricultural Economics*, 49(3), 458-471.
- Midmore P (1993) Input-output forecasting of regional agricultural policy impacts, *Journal of Agricultural Economics*, 44(2), 284-300.
- Midmore, P, Sherwood, A-M, Hounsome, B, Hughes, GO, Jenkins, TN, Roughley, G and Russell S (1998) *LFA policy in Wales: a review of the socio-economic and environmental effects of the HLCA scheme*, Report to the Welsh Office, Aberystwyth: Institute of Rural Studies (The University of Wales).
- Newidiem (1999) *Fam and Agri-tourism Scoping Study*, Cardiff: Newidiem.
- Roberts D (1995) UK agriculture in the wider economy: the importance of net SAM linkage effects, *European Review of Agricultural Economics*, 22(4), 495-511.

Biography

Peter Midmore is an agricultural economist, appointed Professor of Rural Studies at the University of Wales, Aberystwyth in 1997. His research interests are in the effect of agricultural policy on the functioning of the rural economy, and his most recent published work includes papers on the evaluation of local rural development initiatives, the relationship between agriculture and the language and culture of Wales, and economics for sustainable agricultural systems.

26 March 2001