‘CARNAGE BY COMPUTER’: THE BLACKBOARD ECONOMICS OF THE 2001 FOOT AND MOUTH EPIDEMIC

DAVID CAMPBELL AND ROBERT LEE

Cardiff Law School and ESRC Centre for Business Relationships, Accountability, Sustainability and Society (BRASS), UK

ABSTRACT

The foot and mouth disease (FMD) epidemic in the UK in 2001 had devastating consequences including the slaughter of millions of animals and huge losses to the rural economy. The regulatory policies devised to deal with FMD so gravely misconceived the magnitude of the risk that an outbreak was destined to become an epidemic. This paper seeks to draw lessons for regulatory policy by examining the nature of the disaster and the chosen methods of control both before and during the epidemic. It rejects the analysis of the epidemic offered by the government agency responsible and argues that the policies adopted provide a classic example of Coase’s notion of ‘blackboard economics’. The public interventions, although appearing to work splendidly in the abstract, showed little sensitivity to the conditions actually prevailing in modern livestock rearing, and as a result their consequences were not merely imperfect but actually pernicious. We reach the sad conclusion that few lessons have been learned from the outbreak, as the very practices largely responsible for the epidemic are still prevalent, and as legislation and contingency planning show signs of a preparedness merely to repeat the same mistakes.

INTRODUCTION

In a series of papers of which this was the first drafted, we will draw conclusions for regulatory theory and policy from the epidemic of foot and mouth disease (FMD) in the UK in 2001. Our work makes repeated reference to the various local, national and EU official inquiries into the epidemic, including the three specially commissioned by the UK government: *The Future of Farming and Food*, chaired by Sir Don Curry (Curry, 2002); *Infectious Diseases in Livestock*, chaired by Sir Brian Follett (Royal Society, 2002; hereinafter IDL); and *Lessons to be Learned*, chaired by Dr Iain Anderson (Anderson, 2002; hereinafter LTBL). However, we intend our work to be a direct challenge to the most important of these inquiries, LTBL, for the principal lesson to be learned is sadly missing from the report of this inquiry and all other official analyses: the FMD epidemic was not merely badly managed by the government but was *caused* by the government's disease control policies. The 2001 FMD epidemic is a marked regulatory failure which, despite the essential simplicity of the issues in terms of policy formulation, the government still shows little sign of being able to address adequately.

Our argument is that though the agent responsible for FMD is the FMD virus, the 2001 epidemic was caused by the policies of a UK public body, the Ministry of Agriculture, Fisheries and Food (MAFF), devised within an EU strategy for FMD control. FMD was regarded as a problem requiring state intervention, and disease control was treated as a public good, as indeed it has to be if the method of control is large-scale slaughter, for this cannot be carried out other than by the state. However, not merely was no compelling reason officially advanced at EU or UK level why FMD should be regarded as other than a normal business risk, but the conduct of the

public disease control policies was so poor that it resulted in perhaps the largest epidemic of FMD ever known (Clover and Beswick, 2001), certainly the one in which most animals were slaughtered.[1]

This slaughter has occasioned an economic loss which the Department of the Environment, Food and Rural Affairs (DEFRA) estimates to be £9 billion (DEFRA/DCMS, 2002). This figure is but a remote expression of the concrete losses, which include: (1) the premature deaths of over ten million animals (Robertson, 2002; Uhlig, 2002a), killed in ways which were often unacceptably, indeed criminally, inhumane and sometimes so horribly cruel as to be an occasion of lasting national shame; (2) the loss of irreplaceable special breeds; (3) the horror experienced by those with a scrap of humanity involved in the cull; (4) the misery of thousands of small farmers and small businesspersons in areas related to farming and tourism whose incomes were drastically reduced, some of whom were driven into bankruptcy; (5) the (continuing) pollution caused by the disposal of carcasses; (6) the frustration of the enjoyment of the countryside for a year; and (7) a descent into criminal and *ultra vires* (if unpunished) authoritarianism by MAFF, which had to persistently exceed its powers, breach its own regulations, and use excessive financial inducements, or intimidation when these failed, to implement a policy so lacking in merit that it could not have been implemented by rational persuasion. The FMD crisis is, in sum, an object lesson in how not to regulate. There are so many of these lessons readily to hand that the point in drawing attention to this one is the enormity of what was done, for that a policy can be implemented despite having costs on this scale should really deepen even further our awareness of the possible extent of 'government failure'.

Our explanation of why a policy with such disastrous consequences could be adopted involves three specific claims. First, it was the rearing practices central to the

UK livestock industry which created the conditions in which an initial outbreak of FMD (which was inevitable) could become epidemic. Second, the regulatory policies devised to deal with that initial outbreak were hopelessly inadequate to the magnitude of the risk and could not stop the outbreak becoming epidemic. Third, it was because these practices and policies were implemented in an environment of almost total lawlessness that the government's response to their failure could take the form of immense, unlawful slaughter. It is not possible to make all of these claims convincingly within the confines of a single paper. In this first paper we will focus on the second claim, the substance of which has more or less entirely preoccupied public debate and which therefore seems the most appropriate place to start, if only to show how essential it is to expand the parameters of that debate.

We will briefly describe the epidemiology of FMD and the character of the disease control policy taken towards it, and then show how this policy was grossly inadequate to control what became an epidemic. When this paper was first drafted, it was an attempt to evaluate MAFF's performance during the epidemic, for the government was then propounding a seriously misleading evaluation (HM Government, 2002).[2] This is now otiose, at least in a theoretical paper, for, in the light of the overwhelming evidence, there is wide agreement, to which LTBL and even, to a limited extent, DEFRA itself now subscribes, that MAFF's performance was very poor. In these circumstances, LTBL is but one of a large number of influential calls for the government to prepare better contingency plans. With hindsight, many extra provisions for dealing with another outbreak have been proposed: greater numbers of vets to identify the disease; more officials to enforce precautionary measures, particularly the inspection of overseas meat imports; bigger rendering plants; the army maintained at greater readiness; and so on. But the costs of controlling a future

outbreak in this way will be enormous, indeed they appear quite fanciful, and they do not address the root of the matter. If questioned prior to the epidemic, MAFF would certainly have said it had adequate contingency plans in place; and indeed, as we will see, one of the reasons the outbreak became epidemic was that during its initial stages MAFF wrongly insisted that the disease was under control. We will argue that the inadequacy of the contingency plans and the misplaced faith in them is a stark example of what Coase calls 'blackboard economics': policies that work superbly, or even perfectly, on the blackboard, but which are seen to be weak or even risible when the costs of actually implementing them are properly evaluated.

The effort now is to improve public disease control, but whether FMD control *is* a public good is not even asked in any official discussion of which we are aware. Unless this question is adequately answered, working out the proper role of the state is impossible. The maintenance of the assumption that disease control is a public good, itself based in an unquestioned belief that state intervention is the best way to deal with the control of this disease, involves the most blinkered blackboard economics. That the government is persisting in a policy brought into such disrepute by MAFF's performance in 2001 is the worst aspect of the entire episode, other than the appalling cruelty, for it means that, as this is written, the very conditions which produced the epidemic are being recreated.

TWO POINTS ABOUT THE EPIDEMIOLOGY OF FMD

FMD is an epidemic, viral infection to which all cloven-footed animals, including those commonly domesticated for agriculture, are susceptible (OIE, 2000: ch. 2.1.1). It has been known for at least four centuries everywhere in the world where livestock are reared. In 1897 the agent responsible for it was identified as the FMD virus, one of

two members of the apthovirus genus within the family *Picornaviridae*. Two points must be stressed about the epidemiology of FMD: it is an extremely contagious disease but also one which is rarely fatal.

FMD is able to be transmitted by direct contact with infected, carrier animals, by contact with their discharges (FMD virus can survive for weeks or months in animal wastes), by being physically carried on other creatures which cannot actually contract the disease and on inanimate objects such as farm vehicles, and by air over short and long distances (infected animals, especially pigs, exhale the virus). The incidence of long distance transmission by air is highly dependent on environmental factors and on the nature of the specific strain of FMD virus involved, and typically short-range transmission between animals brought into proximity or contact is the major source of infection. In sum, FMD is an extremely contagious disease; 'probably the most contagious virus known in mammals' (*ibid*.) and 'one of the most contagious diseases known to human and veterinary microbiology' (Donaldson and Alexandersen, 2002: 571).

FMD takes its name from an unpleasant symptom infected animals may display, of the growth of vesicles or blisters chiefly in and around the mouth and feet which are painful and which can make chewing and walking difficult, sometimes to such an extent that the animal becomes lame. However, the principal symptom of FMD is fever. The severity of the symptoms infected animals display can differ widely. Infection may easily pass entirely unnoticed especially in herds of sheep, being very hard to detect in the context of normal husbandry practices. It is also a low mortality disease, for almost all adult cattle and sheep and over 90% of adult pigs will recover within two weeks. On the other hand, some weak or young animals may die, and in particular mortality among newly born animals may be high as it induces

myocarditis (heart disease). Adult cattle which recover may display 'reduced performance' in that their ability to gain weight and produce milk may be impaired.[3] However, the point which must be stressed here is that FMD is far from an apocalyptic disease: adult animals rarely die of it but rather recover from what in the literature is often compared to a bout of the flu (Houghton Brown, 2001).

It is very important to note that there are only a miniscule number of (disputed) cases of human beings ever contracting the disease, those cases being claimed to be produced by close contact with infected animals; and it is as certain as one can say that human beings cannot contract the disease by eating food products obtained from infected or vaccinated livestock (Prempeh *et al*., 2001). The Food Standards Agency (FSA) has said that FMD has 'no implications for the human food chain' (FSA, 2001).

THE CONTROL OF FMD

FMD virus is at home everywhere where livestock is reared at all intensively. It remains endemic in wide areas of South America, Africa and Central Asia, and is sporadic throughout much of what used to be called the second and third worlds (OIE, 2002b). (It is very likely that the 2001 epidemic represented the most westward outbreak of a pandemic spread of a strain of the virus which originated in India in 1990 (IDL: para. 4.4 and LTBL: para. 7.2)). Prior to the recent epidemic, FMD was not confined (if this is the right word) to these areas because the virus is particularly suited to them. Rather, FMD virus has had to be actively eliminated from other areas, which demands resources generally available only in the richer, first world countries.

Until the recent epidemic, the EU had claimed FMD free status since 1990, the first year in which there were no recorded outbreaks in Western Europe. In the post-

war period there were thousands of outbreaks annually and the 1990 position was the product of very vigorous post-war programmes of prevention by compulsory, mass, prophylactic vaccination; and, where this failed, eradication by the 'stamping out' of outbreaks by slaughter of all infected and seriously at-risk animals, supported by emergency, targeted vaccination. (Stamping out alone led to FMD free status in the UK, where vaccination has never been practised). In 1990, prophylactic vaccination was made illegal within the EU (Directive 90/423/EEC) and the emphasis placed on slaughter, though emergency vaccination was still permitted in very serious cases (Directive 90/423/EEC, preamble and art. 1(6) amending Directive 85/511/EEC, art. 13; European Commission, 2001). A number of relatively small outbreaks occurred throughout Europe in the 1990s, and these were stamped out by slaughter without general reintroduction of vaccination.

Although the EU decision to cease prophylactic vaccination (and the phasing out of veterinary frontier controls with the creation of the single market in 1992) left an enormous population of livestock fully susceptible to FMD (Donaldson and Doel, 1992), it was by no means necessarily an irrational decision (Leforban, 1999).[4] As the disease can be windborne from outside the EU; as wild, cloven-footed animals such as deer will not be vaccinated; as the disease can be present in imported animal feed (and other meats); and as a vaccine that will eliminate the virus is not presently available, vaccination would have to be a continual process (and would have to be allied with other biosecurity measures) carried out against the sporadic persistence of the disease. Such vaccination is, of course, costly, and imposes further expenditure on continuous vaccine development as the FMD virus evolves to combat current vaccines.

The relative costs of vaccination are not understood at all well (Rushton *et al.*, 2002).[5] What can be said, however, is that (assuming the goal of FMD eradication)

eschewing prophylactic vaccination is dependent on two conditions: that the number of outbreaks will be limited and that such outbreaks as do occur can be quickly stamped out. EU FMD policy places great importance on limiting the number of outbreaks by biosecurity measures of which the prevention of the importation of infected meat has been given the most attention in the wake of the 2001 epidemic (HM Government with the Welsh Assembly Government, 2002: para. 3.1.; cf. DEFRA, 2002c), which official accounts put down to this source (DEFRA, 2002e: para. 19). Limitations of space prevent us from discussing this aspect of FMD control policy here. In a later paper it will be shown to rest on just as flimsy a basis as did the assumption that stamping out would quickly be effective to which we now turn.

THE IDENTIFICATION OF FMD

An adequate stamping out policy must have at its heart a recognition of the two aspects of the disease we have stressed: that it is extremely contagious but rarely fatal. The basic problem is that infected animals live to transmit the disease (IDL: para. 3.16). An outbreak of some size being inevitable, it is therefore crucial to stamping out that measures to isolate that outbreak and prevent animal movements be put in place, as the EU framework legislation has it, 'immediately' (Directive 85/511/EEC, art. 4), and that, as necessary, infected and at-risk animals be disposed of 'without delay' (*ibid*. art. 5). MAFF's national contingency plan was based on this strategy of immediate identification and envisaged up to 10 sites of infection before stamping out was implemented. In 2001, however, there was a complete failure either to identify the disease or to isolate it in anything like a timely fashion; indeed, as we shall see, in a most important way the disease was never properly identified at all.

It is now claimed that an outbreak in February 2001 in a pig-rearing unit in Heddon-on-the-Wall, Northumberland, operated by one Bobby Waugh and his brother, was the source of epidemic (LTBL and IDL). Conditions on this intensive fattening unit would be found disgusting by any reasonable person: e.g. numerous whole pig carcasses were found submerged in animal faeces during the official clean-up (Wainwright, 2002). Waugh was convicted *inter alia* of animal welfare offences, banned from keeping farm animals for 15 years and placed under home curfew (Herbert, 2002). Such satisfaction as one can find in this punishment rather depends on Waugh being the culprit, but even now it is by no means certain that Waugh's unit was the source of the epidemic (European Parliament Temporary Committee on Foot and Mouth Disease (EPTCFMD), 2002a: 46). (It is officially acknowledged (DEFRA, 2002e: para. 19) that the precise source of the infection of Waugh's unit will never be known). Certainly striking curiosities remain of which we will mention but one. When 31 sheep transported to Northern France from Wales at the end of January were tested, ten proved positive, with seven testing highly positive. These results certainly would seem to raise doubts as to the date and location of the outbreak (in February, in pigs, in Northumberland) accepted in the published reports. The MAFF explanation, endorsed by LTBL (52; cf. annex B 'Note of Visit to France'), is that the French testing was too sensitive and produced 'false positives'. But FMD did break out in Northern France and was transported via calves to the Netherlands from a staging point some 200km from the site of the original 'false positive' testing (Pluimers, 2002).

First suspicions of the disease arose not in Northumberland but following a veterinary inspection of pigs at the Cheale Meats Abattoir at Brentwood, Essex on 19 February 2001. Waugh had sent pigs there and they infected other animals from e.g.

the Isle of Wight, and it was in these animals that symptoms were first noticed. In the time it took to confirm the diagnosis and slaughter the infected animals, neighbouring premises were infected (LTBL: 54-7; Studd, 2001). The tracing of the animals passing through the abattoir suggested that Waugh's unit – at the other end of England - was the source of infection. Nationwide animal movement restrictions were put in place on 23 February 2001. Between 20 and 23 February a very substantial number of animal movements took place around the country, and these undoubtedly spread infection widely (LTBL: 59). Even after these controls were imposed, now illegal movements continued and there have been hundreds of investigations into these (Vidal and Brown, 2001).

But even worse, the disease had been present on Waugh's unit since 12 February and perhaps as early as 26 January (DEFRA, 2002e: para. 5), though whilst his pigs must have shown symptoms which would have been detected with reasonable diligence, he never gave notification of the disease. These pigs had infected sheep on a neighbouring farm before 19 February. Sheep sent from this farm to Hexham Market on 13 February were infected, though probably in a way that was not reasonably detectable. There were 3,800 sheep passing through the hands of 120 dealers at Hexham Market on that day (HM Comptroller and Auditor General (HMCAG), 2002: para. 1.7; Elliott, 2001; Cumbria Foot and Mouth Disease Inquiry Panel, 2002: 25). Those animals and dealers were involved in nationwide animal movements. It follows that the way MAFF established movement controls was impossibly dilatory given that via Hexham market alone over 24,000 potentially infected animals were being dispersed widely across the country before it did so (LTBL: 51)!

For this reason, there certainly were over 50 (LTBL: 51) and there may have been over 100 (King, 2002) sites of infection by the time of the first confirmation of the disease in Essex. Stamp out depends upon an ability to trace animals as they move around the country so that MAFF can know where the stamping out has to take place, and possession of a robust animal movement monitoring system is central to the EU's FMD policy. The tagging of animals for the purposes of ensuring they have been subject to the specified biosecurity procedures and tracing them in the event of an outbreak is therefore the cornerstone of UK disease control policy. However, the huge investment in tagging and record keeping makes sense only if the scale of animal movements is such that it is feasible to trace contacts in order to isolate infected premises, i.e. to trace more quickly than the disease is spread by animal movements. The number of movements that take place within the UK livestock industry, much less the EU as a whole under the single market, make it extremely unlikely that this condition will always obtain (Bourbakis and Allinson, 2001-2). In 2001, there was a tremendous disparity between the capacity of the control system and the actual volume of livestock movement. Infected animals were shipped the length of the country and brought into contact with animals from most other parts of the country, before themselves being moved on (LTBL: para. 8.2). A policy which was intended to spread the disease would not be much different.

The failure by MAFF to understand the size of the risk it was attempting to regulate was compounded by its consequent misplaced initial confidence that it could control the spread of disease. A few days after the discovery of the disease at the Cheale abattoir, the recently established FSA issued a press release congratulating itself on the 'vigilance' which allowed it to make that discovery, clear evidence of its having successfully carried out one of its 'key roles [of ensuring] that no unfit animal

enters the abattoir' (FSA, 2002). This optimism was entirely misconceived, but statements such as this produced the impression that MAFF was in control of the outbreak and in the process of eliminating it. LTBL (para 9.1) states that other 'government departments were not greatly involved at this stage, largely because MAFF was not asking for help'. LTBL suggests that complacency within MAFF about disease control affected the entire Department:

> Individual groups and managers not directly involved with the outbreak remained focused on their own targets. There was no incentive to release staff to help in the fight against FMD (*ibid*.: para. 9.2).

On 11 March, Mr Nick Brown, then the Secretary of State for Agriculture, appeared on *Breakfast with Frost* (*ibid*.: para. 9.7; cf. annex E). He stated that the disease was under control and, when pressed, repeated that he was 'absolutely certain' about this. As LTBL points out, there was no evidence on which to base this view: 34 cases of FMD had been notified in the two days prior to Mr Brown's statement, 164 cases had been confirmed in total, and in Cumbria alone there were over 40,000 carcasses awaiting disposal.

The tardiness in identifying and isolating the disease together with the misplaced confidence in the ability to trace animal movements and therefore to operate stamp out effectively meant that in the early weeks FMD spread alarmingly. To give but one example of what was happening: William Cleave, now thought to be the first person to be affected through dealings at the Hexham Market, was one of the largest operators in Devon, working from thirteen different sites in the County (Gillan, 2001). It seems to be accepted that the movement of Cleave's animals was the sole source of the introduction of the disease into the County, but Devon eventually suffered 173 confirmed outbreaks of FMD.

That the disease obtained an ascendancy (LTBL: ch. 9) is largely attributed to its 'silent spread' (LTBL: ch. 7; DEFRA, 2003). But it is misleading to say that the disease was silent as it spread; rather the evidence it gave of its ascendancy was either not heard or was drowned out by MAFF's deafening claims that all was under control. For many farmers, of course, the pressing evidence of their own eyes was that this was not the case, and the eventual exposure of the worthlessness of these claims led to a climate of panic and an erosion of trust between the ministry and the affected parties: in the words of one farmer giving evidence to LTBL (81): '[w]e felt absolutely insulted and patronised by these lies that we were told'. This was a major cause of the repeated breakdowns in the relationships between MAFF and farmers (Cumbria Foot and Mouth Disease Inquiry Panel, 2002; Mercer, 2002) which put at risk the co-operation between the two on which any successful FMD control policy must rest.

There is much more we could add about the initial handling of the outbreak but this is enough for the purposes of this paper. The conclusion which must be drawn is this: the 'game' of control of the 2001 FMD outbreak was lost before MAFF heard the starting whistle. We now turn to how MAFF dealt with a situation which, from the outset, was beyond its rational control by compounding the irrationality.

FROM CULL TO CARNAGE

Some five weeks after the initial outbreak, the response to the epidemic was placed in the hands of the Cabinet Office Briefing Room (COBR),[6] which co-ordinated the work of all government departments, including the army, in handling what had by then become a disaster which was out of control. COBR is the *ad hoc* committee which is convened to deal with national emergencies such as the possible terrorist

threat immediately after 11 September 2001. It meets in a reinforced subterranean bunker in which televisions monitor sensitive areas of London. That COBR had to be involved at all is a sure sign that MAFF had lost control. The incredible state of affairs in which a regulatory problem of livestock rearing and farm economics was thought to require a response by a government apparatus designed to deal with problems more akin to general insurrection has passed with little other than approving comment in the official reports (e.g. LTBL: ch. 11). (A principal official criticism of MAFF has been that the army was not was not given a major role at an earlier stage (LTBL: para. 9.8; Committee of Public Accounts (PAC), 2003: para. 5)).

At the time COBR took charge, the contiguous cull policy was introduced. Slaughter on a 'precautionary' basis (LTBL: 89) was used to create a firewall around premises suspected of being infected. This is *not* what previously was meant by stamping out, the international standard definition of which (OIE, 2002a: art. 1.1.1.1.) is in terms of tracing infection or reasonable suspicion of infection:

> [stamping out is] carrying out under the authority of the Veterinary Administration, on confirmation of a disease, the killing of the animals which are affected and those suspected of being affected in the herd and, where appropriate, those in other herds which have been exposed to infection by direct animal to animal contact, or by indirect contact of a kind likely to cause the transmission of the causal pathogen.

As it was realised that MAFF had lost control of the epidemic, all but the pretence of the killing being related to infection or reasonable suspicion of infection was dropped to be replaced by a preventative, contiguous cull when grasp of the size of the epidemic had been lost. There was inevitably great confusion regarding the scope of the contiguous cull, which from the outset was felt to be 'neither practical nor likely to be legal' (LTBL: paras 10.3, 17.3), and MAFF faced hundreds of cases of strenuous resistance to it. The legislation permitting slaughter (Animal Health Act 1981) envisaged the success of stamping out in the sense of slaughter linked to the

tracing of infection. But contiguous culling to create a firewall is not based on tracing and therefore was, as we have argued in another paper (Campbell and Lee, 2003b), *ultra vires*. This has remained an extremely vexed issue which the government has sought to resolve, to its own satisfaction at least, by passing the Animal Health Act 2002, which gives the Secretary of State power to kill 'any' animal he deems it necessary to kill for the purposes of disease control and so, if granting this extraordinary discretion is good law, allows firewall culling in future.

In its typical form in 2001, the contiguous cull involved the slaughter of all animals on premises which shared a boundary with a premises where livestock were suspected of being infected. The word 'contiguous' may be a misleading description of this procedure. In this context, contiguity might be expected to imply (suspicion of) a chain of infection, but the cull proceeded in the absence of any such chain; contiguity meant simply sharing a boundary. In Cumbria and in Dumfries and Galloway, animals were culled even on premises which did not share a boundary but were contiguous in an even more stretched sense in that they were within a 3 kilometre radius of a premises declared infected.[7] That is to say, a circle with a radius of 3 kilometres having those premises at its centre was drawn on a map, and all premises within that mapped circle had their animals culled regardless of infection or suspicion of infection. The 3 kilometre cull seems to have been retained to 'expand' the firewall in these areas (Cumbria Foot and Mouth Disease Inquiry Report, 2002: 41). The three-kilometre radius is not entirely accidental but corresponds to the protection zone demanded by Directive 85/511/EEC, art. 9. A protection zone is not, however, by any means a 'cull' zone; the EU conceived of it as a zone within which animal movements would be halted, surveillance of animals maintained, and perhaps vaccination carried out. In the UK, it became a killing zone.

The implementation of the contiguous cull was guided by computerised mathematical modelling carried out by the FMD Science Group (LTBL: 91). This Group was convened under byzantine arrangements which defied such formal constitutional procedures as actually existed in a way entirely typical of the government's response to the crisis (Shannon, 2002). It was composed of abstract epidemiological modellers who had almost no knowledge of non-human viral epidemiology, of relevant agricultural or veterinary practice, or, indeed, of regulatory issues (Beat, n.d.). The way the FMD Science Group worked was described to the Devon Independent Inquiry by Mrs Wendy Vere, a West Country veterinary surgeon:

> Their idea was to control the disease by culling in contiguous farms. That is absolutely fine if you are sitting in front of a computer screen in London. However, it is different on the ground. A person in London will just see the numbers and will say that they have to be taken out. That is why it was carnage by computer (Mercer, 2002: para. 1.25; cf. Doyle, 2001).

The FMD Science Group modelled an abstract spread of infection from premises to premises in such a way that the rate of slaughter thereby sanctioned was larger than the hypothesised rate of infection, and it did prove to be the case that the combined forces of the apparatuses of the UK state, including its army, had a greater capacity to kill domesticated animals than FMD to spread, at least once animal movement restrictions were in place. The disease did stop, but as even those responsible for it had to admit, this approach was 'over draconian' (Highfield, 2001). The Science Group's model took no heed of concrete information about the likelihood of the transmission of disease beyond the original suspicion of infection (Kitching, 2002). It took no account whatsoever of the possible variable conditions of spread according to factors such as geography. It made no allowance for natural barriers which might restrict spread. It made no distinction between infected species, let alone infected herds or individual animals. It almost certainly overestimated long-range

wind-spread, for the weight of evidence is that in the case of this particular strain of virus, direct contact or airborne transmission between animals in close proximity were very much more important vectors of transmission (Donaldson *et al*., 2001). Finally, it made no distinction between different farming practices in different regions, and allowed no assertion that a farmer had exercised rigorous biosecurity measures. Typically, any farm which shared a boundary with a premises declared infected or, in the case of the three kilometre cull, was within a three kilometre radius of such premises, had all of its animals (sometimes including domestic pets) culled in a process of 'postcode slaughter' (Windsor, 2001).

This indeed was, as Mrs Vere showed great perspicuity in saying well in advance of LTBL, 'carnage by computer'. It was indefensible in principle, but we must add that the management information system deployed was unfit for the purpose of the cull, being one normally used for the purpose of calculating CAP subsidies, and had to be very substantially reengineered during that cull (LTBL: para. 9.3). The farm location or other geographical information used was simply wrong in a large proportion of cases. So poor was the data that, for example, the grid reference given for a number of farms placed them in the North Sea (Select Committee on Environment, Food and Rural Affairs (SCEFRA), 2002: Evidence of Professor Roy Anderson, 7 November 2001, Q. 260). Even in July 2001, towards the end of the crisis, there were still over 800 infected premises which the control system recorded as having zero animals (HMCAG, 2002: 78)! In sum, as LTBL (72) had it:

> Information was frequently out of date, on occasion by several years. It was sometimes difficult to pinpoint the location of livestock accommodation within an individual holding, or identify the operator of that land.

Nor was the basic epidemiological data received by the FMD Science Group acceptably accurate. One in three diagnoses appears to have been incorrect (Anon,

2001; HMCAG, 2002: 63). This would not be surprising given the immense pressures on the State Veterinary Service (LTBL: para. 9.2), which in part were met by the use of veterinary scientists with no effective experience of FMD and of questionable English language competence (discussed below). But in the climate of horror and panic set by the doomed attempt to meet the 24/48 hour targets (discussed below), slaughter only on the basis of diagnoses confirmed by clinical analysis was replaced by a policy of 'slaughter on suspicion' (LTBL: para. 10.4). Such suspicion was based on symptoms detected by a vet in the field, although FMD can be very difficult to diagnose in this way, especially in the most affected animal, sheep. Four in every five of these suspected slaughters did not involve an actual outbreak of FMD. It is essential to recall when reading these figures, that each of these suspected slaughters often then led to culling on contiguous farming units. On average, there would be four such units. In total, 2,026 farming premises declared infected produced pre-emptive culling on a further 8,131 premises (LTBL: 170).

In sum, stamping out was abandoned in all but name. Mass, almost indiscriminate killing took its place. The leader of the FMD Science Group has acknowledged that the contiguous cull was 'a blunt tool', but, he claims, 'in the crisis … it was unfortunately the only tool available' (Uhlig, 2002c), the crisis being that MAFF had produced a situation in which 'the epidemic was not under control' (LTBL: p. 92). SCEFRA has rightly observed that '[t]he contiguous cull was a response to a desperate situation, not a pre-mediated response to a known, assessed risk' (SCEFRA, 2002: para. 27).

By the end, well over 10 million animals were killed. Perhaps 90% of these animals were not infected. Uninfected animals were killed because they were wrongly diagnosed; were uninfected but were believed to be at risk; were uninfected and not

actually at risk but were contiguous to animals it was claimed were infected; were among 2 million young animals killed with their mothers; or were among 2 million animals killed in what may well take the heavily contested prize for doublespeak in this episode, the 'Livestock Welfare (Disposal) Scheme', under which uninfected and not at risk animals were killed because animal movement restrictions imposed growing husbandry costs on their maintenance.

The contiguous cull policy turned on a target of slaughtering stock on premises infected or suspected of being infected within 24 hours and slaughter of stock on contiguous premises within 48 hours. This so-called '24/48 hours slaughter policy' is an attempt to comply with the 'immediate' or 'without delay' requirements of the basic EU control scheme based on exclusive use of stamping out. This target may be have been feasible in a small-scale outbreak, but it was impossibly demanding given the numbers of animals involved in 2001. Inevitably it was met in fewer than 50% of cases (LTBL: para. 10.4), and in even fewer in the areas where MAFF believed it was most needed (HMCAG, 2002: paras. 2.12-2.13). The extreme haste imposed by the attempt to meet it was, however, the main reason the cull was so despicably cruel (*ibid*.: 70). This 'policy' emanated from a 10 Downing Street lobby briefing. The reader will hardly believe it, even in the context of this story, but no justification was then given or has ever since emerged for this central plank of what has passed for disease control policy (LTBL: para. 10.3), and as the facts are now clearer and as a justification of impossible targets which occasion huge suffering is difficult, one imagines it never will.

One despairs to note that it is simply not known even now what role the contiguous cull played in stopping the disease (EPTCFMD, 2002a: 53). That cull was a panic response to a crisis which MAFF had allowed to assume unknown dimensions

which, of its nature, has made proper epidemiological analysis of the epidemic impossible. As animals were killed on very flimsy or no suspicion of infection and as the cull was not implemented according to the timescales which were said to be essential, it was a set of circumstances which MAFF did not understand then and DEFRA does understand now that caused the epidemic and therefore the cull to stop when it did. The animal record and epidemiological information available to MAFF was so poor (Kitching, 2001) that the course of the epidemic or even the numbers of infected animals will never be known with reasonable accuracy. As we therefore do not even know the real nature and extent of the epidemic, the role the cull played, even if it is properly assessed as a firebreak, is extremely unclear; it is not even agreed that that it played *any* positive role (EPTCFMD, 2002a: 53)! However this was, the contiguous cull certainly was a remote, abstract policy relying on bad information and wildly optimistic beliefs about slaughter and disposal capacity which decayed into an unjustifiable massacre.

DEFRA'S ANALYSIS OF THE EPIDEMIC

In the light of this, the reader may be surprised to hear that DEFRA's principal response has been to claim that the contiguous cull was overall a success, in the sense that the epidemic was stopped. In DEFRA's first major performance report, Mrs Margaret Beckett, now Secretary of State for Environment, Food and Rural Affairs, nobly acknowledged that MAFF/DEFRA had not met its 1998 target 'to prevent outbreaks of serious animal, fish and plant disease'. However, she went on to say: '[t]his should not diminish the achievement in tackling an epidemic of the scale of the 2001 … epidemic' (DEFRA, 2002a: 2). Rather in the latter vein, her Parliamentary response to LTBL pleads that the epidemic was unforeseeable, being due to 'a rare set

of circumstances' – and that this largely excuses those failures which DEFRA now does acknowledge (Secretary of State for Environment, Food and Rural Affairs, 2002).[8] But for DEFRA and the various official reports to say, as they essentially do, that no contingency planning could have foreseen this risk is simply a disgrace. The National Audit Office's (NAO) report, for example, unambiguously states that MAFF's contingency plans were insufficient to deal with the outbreaks that led to the epidemic; but also concludes that no contingency plan could have coped with this outbreak, which was of an 'unprecedented' size. In sum, the NAO agrees with MAFF's view that this mitigates MAFF's failure (HMCAG, 2002: 4; cf. PAC, 2003: para. 1).

Once this is accepted, then acknowledged 'mistakes of strategy' can be excused as good faith responses to a crisis by 'government officials [who] made heroic efforts to fight the disease' (HMCAG, 2002: 4). An emergency does excuse a lack of perfection in one's responses, but not when it was one's incompetence which produced the emergency in the first place! Mrs Beckett's extreme example of rejoicing that her Department burned the house down to roast the pig loses its plausibility when the simple point is made that MAFF had complete regulatory control over animal health and, through CAP subsidy, very substantial financial control over the livestock industry (which is not viable in its present state without such subsidy). The central feature of official discourse after the epidemic is that it fails to make the crucial link between MAFF's failure to be aware of the size of the risk posed by the livestock industry, which it extensively regulated, and the way this undermined the disease control system it designed and (purported to have) implemented. In effect, it uses the absence of that link as an excuse. MAFF indeed did not foresee the 'unprecedented' epidemic, but this is why it is so grossly culpable, not

why it is excused culpability.[9] If a private business stored such a large quantity of flammable materials on its premises that its fire control measures could not cope with the great size of a fire caused thereby, would it be excused from liability for the damage caused if it honestly pleaded in its *defence* that it hadn't kept an accurate estimate of the risk because it had no idea what quantity of materials were stored? In the simply bewildering world of official discourse about FMD, obvious questions seem not to be able to be asked and obvious responsibilities seem not to be able to be sheeted home.

Certain facts about MAFF's performance need to be stressed in order to try to draw productive regulatory lessons from this disaster. MAFF's contingency planning was largely a paper exercise. The national contingency plan was formulated pursuant to art. 5(2) of Directive 90/423/EEC in accordance with general criteria laid down in Decision 91/42/EEC and approved by Commission Decision 93/455/EEC. With the vital exception of measures in respect of emergency vaccination, to which we shall return, such failures to transpose EU measures into national law as had occurred raised merely 'technical' issues (which are being addressed by amendment of the secondary legislation). What was not merely technical was the fact that the EU institution charged with implementing disease control policy, the Food and Veterinary Organisation (FVO), had completely neglected to review the UK contingency plan or the readiness to implement it between its approval in 1993 and the time of the epidemic (EPTCFMD, 2002a: 41-2).

This startling EU failure was entirely matched at national level. With the exception of updating contact names, telephone numbers and minor facts in July 2000, the UK national contingency plan remained unchanged from the date of its approval (HMCAG, 2002: para. 2.9). This is not as amazing as it appears when it is

realised that this plan was largely an internal MAFF document! In the course of the piecemeal accumulation of various provisions and plans that, together with the gaps between those provisions and plans, constituted MAFF's FMD contingency planning, MAFF 'had not formally consulted other key stakeholders, such as other government departments, local authorities and representatives of farmers and the veterinary profession' (*ibid*.: para. 2.53-2.57). Far from being widely publicised and rigorously tested, what passed for a plan was not even put on the DEFRA website until August 2001; its existence was entirely unknown to e.g. the Ulster Farmers' Union (EPTCFMD, 2002a: 52), and almost all key organisations outside of MAFF knew nothing of its detail (PAC, 2003: para. 6(i)).

In crucial respects, the contingency plan was entirely based on heroic assumptions. MAFF adopted a strategy of 'passive surveillance' which is entirely dependent on farmers harbouring FMD to notify this to the authorities. We are unaware of any attempt by MAFF to assess the likelihood of compliance, either in terms of assessing the incentives for farmers to report known disease or being able to detect disease. The seeding of the 2001 epidemic occurred because of radical failures in both, and there surely are very serious questions about both, especially in terms of the likelihood of detecting disease in sheep (IDL: ch. 7), although the national sheep flock has been increased by 50% since 1967 (IDL: 11). Nevertheless, the contingency plans 'did not allow for the possibility of the disease not being reported, nor did the plans consider that the disease might subsequently be spread through sheep, where it would be difficult to detect' (PAC, 2003: para. 11).

To work at all well, epidemiological tracing obviously requires adequate numbers of veterinary personnel. EU guidelines on contingency planning demanded that Member States provided resources for the immediate availability of trained staff

to cope with up to ten cases at any one time and to maintain surveillance within a three kilometre protection zone of each case (European Commission, 1991). The 2001 outbreak generated demands for resources considerably in excess of this. There were not enough vets (or other MAFF or other agency personnel) to hand; MAFF 'simply ran out of vets', as the PAC had it (Uhlig, 2002d). By way of illustration of the magnitude of the shortfall, LTBL states that around 80% of the vets in the State Veterinary Service (SVS) were needed to tackle the swine fever outbreak of 2000, even though that was confined to just 16 cases (LTBL: para. 9.2). The Drummond (1999) Report on the preparedness of the SVS had argued that the SVS was unable to meet its obligations, but as nothing much was done about this, the Devon Inquiry into the epidemic was obliged to report that the SVS had been 'run down over the last two decades and was greatly over-stretched during the outbreak and its aftermath' (Mercer, 2002). During the epidemic itself, simply making more funds available could not remedy the problem which had been created; adequately trained and experienced personnel just were not available. When it became clear that the SVS could not cope, additional vets, including vets from abroad or trainees, were recruited to assist. Perhaps most of these personnel would not have been regarded as good enough in any other than emergency circumstances; they certainly had but a very limited knowledge and experience of FMD, and serious problems of English comprehension which led to great difficulties in the diagnosis of the disease were common.

Most importantly, MAFF's having a disease control system in place when it had no idea of the magnitude of the risk that the system was meant to control makes that entire system absurd. This risk is largely[10] represented by the numbers of animal movements, and the fact that MAFF's planning was simply hopeless in proportion to this risk was exposed by the FMD epidemic. British livestock rearing is a system to

which long distance live animal movement is absolutely central, and there can be no doubt whatsoever that the basic reason the outbreak became epidemic was the number of live animal movements which takes place. There are, so far as we know, no accurate estimates of total animal movements in the UK (Rushton *et al*., 2002), and that none of the three principal inquiries has attempted to deal with this central issue is itself a problem calling for social scientific explanation. By keeping separate the inquiry into animal health regulation (LTBL) and the inquiry into farming practices (Curry, 2002), the government has failed to make exactly the connection that must be made, and condemned both inquiries to miss the fundamental point.

In the absence of the official collation of the necessary information, we will emphasise three facts. First: immediately prior to the 1967 epidemic, there were 2,200 abattoirs in the UK, but at the time of the epidemic there were 360 (LTBL: 26). During the 1990s, whilst EU policy created a huge at risk livestock population, more than two thirds of existing abattoirs were closed (Kennard and Young, 1999). The resulting increase in the volume of animal movements within the UK has not, to our knowledge, been precisely quantified, but the BSE inquiry found that in 1994, as a result of abattoir closures, 20% of cattle travelled very long distances to slaughter, literally including movement from northern Scotland to the south east of England (Phillipps, 2000: vol. 12, para. 4.14). Abattoir closures sometimes resulted from the imposition of new EU hygiene standards (Shaoul, 1997). However, alongside this were significant changes in food production and consumption. More than 80% of meat for human consumption is now handled through a major supermarket chain. The desire of many such retailers to produce meat presented to the consumer uniformly dressed and packaged means the concentration of meat production in certain chosen abattoirs. Many objections have been raised to this in terms of the destruction of local

and small-scale food production and the degradation of food quality. The point we wish to stress, however, is that it has been done without any consideration, so far as we are aware, of the stress it placed on the FMD biosecurity regime.

Second: there are an enormous number of live animal movements between the UK and the rest of the EU (Lucas, 2001). Some 600,000 to 800,000 lambs are, for example, exported from the UK annually (Bennett *et al*., 2000: fig. 4.4). Given all that we know of the epidemiology of FMD, this is an extremely hazardous practice, and again there seems to be no analysis of the stress it places on the FMD biosecurity regime. Farmers selling live lambs abroad gain a premium of about £3 per head before the extra costs of transport and in 2000 the business as a whole generated gross receipts of £31 million. We have been unable to identify any attempt to relate this to the costs of the stress these sales place on the FMD biosecurity regime.

Third: there is what appears to be a huge but of its nature not precisely known dimension to animal movements created by CAP subsidy. Not long after the FMD outbreak, MAFF introduced a 20-day standstill restriction on stock movements after initial shipment. Explaining the need to introduce this measure, that stock figure of the modern promulgation of regulatory initiatives, an unidentified 'Cabinet Minister', was quoted as saying:

> Nobody took account of the extent to which dodgy farmers moved sheep around to claim quota payments. That is the true story (Prescott and Leake, 2001).

This is a reference to the practice of 'bed and breakfasting' farm animals so that the numbers of animals forecast for the farm early in the season are actually available to the farmer at the time of inspection, thereby avoiding any shortfall in quota payments (Committee on Church and Nation, 2001). The 'Cabinet Minister' is alleging that farmers who have a shortfall in forecasted numbers when the census for the purposes

of the calculation of quota payments is taken borrow animals in order to ensure a higher quota payment. There are other variants of illegal movement which turn on the workings of CAP which are too arcane to spell out here. It will suffice to give one illustration of their consequences: the disease was spread to Scotland, Northern Ireland and the Republic of Ireland by a single dealer looking to gain a £10 per head premium plus a 4.5% VAT rebate by illegally passing off English lamb bought at Carlisle market as Irish lamb (Cowan, 2001; Sheenan and Kearney, 2001).

The rapidity of the spread of FMD to a large number of sites across a wide geographical area ought to have caused an early and critical review of the stamp out policy, including early consideration of other possible disease controls such as vaccination. Stamp out envisages containment; persistence in exclusive use of the policy when faced with an epidemic will inevitably mean huge slaughter and concomitant huge interference with the rural economy. In 2001 it meant the countryside was, in essence, placed off-limits, causing great inconvenience and huge losses to the tourism industry. The EU legislative framework specifically anticipated that emergency vaccination might be necessary 'in extreme situations where an epizootic disease threatens to become extensive', and Council Directive 90/423/EEC, art. 1(6) amends Council Directive 85/511/EEC, art. 13 to mandate that certain steps be taken in this respect. However, MAFF had such confidence in being able to trace infection that its contingency planning made no provision for a 'worst-case scenario' (EPTCFMD, 2002a: 9), and therefore UK '[c]ontingency planning for vaccination was minimal' (LTBL: para. 13.4). In the absence of any such planning, there was, of course, inadequate resources available to carry vaccination out. The huge logistical lacunae are described extensively in the official reports. In sum, in the words of the Chief Veterinary Officer:

> No estimate (had) been made of the human resource requirements for a vaccination programme…The assumption (was) made that a stamping out policy would be operated first and that, if sufficient trained resources were immediately available as outlined, vaccination could be avoided (LTBL: 124).

The decision not to vaccinate was the product of an extremely heated 'debate' *during* the epidemic. This debate was very largely based on misunderstandings of EU and WTO biosecurity and trade policies maintained by certain special interest groups, notably the national leadership of the National Farmers' Union, which had 'undue influence' over policy-making (EPTCFMD, 2002a: 54-5), and we will examine this debate in detail in future work. What can be said here is that it is preposterous that it should have taken place under these circumstances at all. The issue should have been settled in advance in any at all competent contingency planning. But 'because of other priorities and a shortage of available resources', MAFF had never undertaken a specific risk assessment of FMD (IDL: para. 2.15). To the extent that its exclusive commitment to stamping out was based on any fundamental evaluation of stamping out's relative costs, it was based on a very influential 1973 cost-benefit analysis using data from the 1967 outbreak which argued for stamping out without vaccination (Power and Harris, 1973). Power and Harris' paper is much cited but evidently little read. It is a carefully nuanced paper which stresses the limitations of the empirical data which it uses and therefore the limitations to the confidence which can be had in its conclusions, and it is quite wrong to take it, as it has been taken, to be overwhelming authority for exclusive reliance on stamping out.

Leaving aside the objections which might be raised to this study itself (Berentson *et al*., 1992), the intervening quarter of a century, during which the nature of the rural economy and therefore the economics of vaccination had, of course, changed dramatically, rendered this study obsolete in many respects (Roberts, 2001).

It was only because 'the economics of slaughter do not seem to have been recalculated for decades' (Houghton Brown, 2001) that the decision to persist with slaughter could be portrayed as maximising welfare. It committed enormous public expenditure to the defence of livestock exports at the cost of inflicting huge damage on the tourist industry, and, whilst the precise figures are open to dispute, it is unarguable that the value of the former is much smaller than the costs of the latter (DEFRA/DCMS, 2002). In sum, the result of MAFF policy in 2001 was that 'the losses to the livestock sector … were dwarfed by the … losses to the tourist sector' (Rushton *et al*., 2002). In what must be regarded as a masterpiece of understatement, LTBL (para 14.4) concluded that an updating of the costs and benefits used in MAFF's cost-benefit calculation 'is overdue' because a 'number of factors is likely to have changed since the 1960s'.

It is readily understandable, then, that when taking evidence about the epidemic from the UK government, EUTCFMD (2002b: Q. 14) received only a very vague answer to its question: '[w]hy, when the epidemic met all the criteria for an emergency vaccination programme laid out in E.C. Directive 90/423, did the UK government not adopt such a programme'. The EU was itself by no means beyond blame, however, for the FVO had failed to ensure that adequate planning for emergency vaccination had taken place (EPTCFMD, 2002a: 41-2). In sum, this 'was a major flaw in UK contingency planning and policy implementation which should have been reviewed and appropriate corrective action taken' (*ibid*.: 9).

We could go on, for we have merely outlined the incompetence which MAFF showed prior to and during the epidemic. But our purpose here is not to provide exhaustive evidence of this incompetence, for diligent perusal of the official reports yields that evidence, but to set up the following discussion of the fundamental

regulatory issue which is not adequately addressed in those reports. LTBL (37) points out that:

> Contingency planning is not just producing a written document. Rather it is about putting in place the systems, processes and culture to respond effectively to crises.

This is, of course, right, and so far as it goes its logic is that contingency planning should be improved. Such planning will, however, be undermined unless we know the institutional reasons why this blatant incompetence could take place, which in turn requires an answer to the question how could MAFF ever have got itself into a position where rearing practices, for the regulation of which it was completely responsible and over which it exercises crucial financial control, caused a harm which it now pleads in its excuse that it did not foresee?

COASE, BLACKBOARD ECONOMICS AND FMD

That interventions have been beset by a crisis of effectiveness (Hawkins, 1984), and necessarily therefore of authority (Nonet and Selznick, 2001: 4-8) or legitimacy (Habermas, 1976: 24-31), and that this requires a fundamental 'reconceiving' (Sunstein, 1990) of the nature of the '(re-)regulatory state' (Majone, 1994), has been the commonest currency of regulatory theory during the post-war 'age of regulatory reform' (Button and Swann (eds), 1989). Some of the contributions to this 'reconception' are of great sophistication and, indeed, sometimes complexity and difficulty. Their core notion of 'reflexivity' (Teubner, 1993) or 'responsiveness' (Ayres and Braithwaite, 1992) does, we will argue in future work, have a role to play in the reform of FMD policy. However, we feel that the errors that led to the foot and mouth epidemic are subject to perfectly straightforward criticisms: these policies were, as Ronald Coase (1964: 195) has it, purely abstract 'blackboard economics'.

We will argue that the only general explanation that can be given for so poor a performance by MAFF is that it had unreasoning confidence in its policies, not despite but precisely *because* it had never properly assessed their plausibility as concrete regulatory measures.

The criticism of MAFF's FMD policy as blackboard economics is a most disturbingly easy argument to make, which is itself a point of note. Though we cannot argue what we acknowledge is a contentious point here, in our opinion it has never been soundly established that doing nothing about FMD other than endure it (or, rather, respond only with raised levels of husbandry) might not be the wisest policy. We can say that the case that stamp out alone is the best policy certainly has never been convincingly made (Woods, n.d., 1999, 2002). Looking merely at the situation immediately prior to the epidemic, subsequent to the decision to cease vaccination in the EU, we find that there was *no* UK official consideration, or therefore defence, of treating FMD control as a public good;[11] and one can hardly be surprised that regulatory policy formulated with this frame of mind has collapsed when placed under strain. It was the mere fact that there was public regulation of FMD that seems to have been enough for MAFF to believe it had the problem under control; and this illusion of regulatory capacity hid an enormous risk which, in the end, blew the illusion apart. Uncannily direct resonances with Coase's famous criticisms of unwise intervention show just how feeble was MAFF's regulatory policy.

Coase's argument against Pigouvian welfare economics strikes both at the identification of market failure and at the adequacy of intervention as a response to what are claimed to be market failures. Coase hardly denies that there are market failures. Indeed, it is the burden of the concept of the transaction cost which he has done so much to make central to economic thinking that, as general competitive

equilibrium can occur only when transaction costs are zero but transaction costs are always positive in the empirical world, market failures are ubiquitous. When one is actually claiming to observe a market failure, one cannot really be pointing to the fact that allocations are not perfectly efficient, for there can be no more mundane observation. One must be pointing to a state of affairs one both thinks bad and which, implicitly at least, one thinks could be improved by intervention. Recognising this, it becomes clear that even if one identifies a market failure which it is thought right to try to correct, it is not enough to ground intervention to point to that failure. One must show that the alternative of intervention would be superior to what the failed market has done. Simply to advocate intervention because one is dissatisfied with the market is a flat *non sequitur*. One's perception of 'market failure' must be complemented by a perception of 'government failure' when making choices between alternative governance structures for the allocation of economic goods (Coase, 1964: 195).

What now seems inexplicable but certainly was the case until quite recently in welfare economics and regulatory theory and policy based upon them, is that it typically was inadequately recognised that government intervention itself involves transaction costs, and that this can lead government bodies to 'fail' as well as markets. Given that public bodies are themselves imperfect, there is no necessity for intervention to be superior to the market even when the market is shown to have failed. An intervention may be shown on the blackboard to offer a theoretical solution, but the reason it appears to do so is that its own costs are very inadequately estimated because there is an underlying assumption that the intervention will be carried out by more or less efficient public bodies. The apparent plausibility of the interventionist solution rests on the inaccurate underestimate of the cost of intervention. Solutions which work well on a blackboard but are developed without

sufficient sensitivity to the problems of their being implemented are very likely to be useless or pernicious when they actually come to be implemented. When, for example, Baumol replied to Coase's attack on Pigouvian taxes for the regulation of pollution but admitted that '[w]e do not know how to calculate the required taxes and subsidies and we do not know how to approximate them by trial and error', Coase in turn responded:

> Apparently what Baumol meant by saying that "taken on its own grounds, the conclusions of the Pigouvian tradition are, in fact, impeccable", was that its logic was impeccable and that, if its taxation proposals were carried out, which they cannot be, the allocation of resources would be optimal. This I have never denied. My point was simply that such tax proposals are the stuff that dreams are made of. In my youth it was said that what was too silly to be said may be sung. In modern economics it may be put into mathematics (Coase, 1988:185).

Whatever the position that now obtains in regulatory *theory*, regulatory *policy* as exemplified by MAFF's FMD control policy evidently is subject to both limbs of Coase's critique of intervention, though we shall only briefly discuss the former. Unless by market failure one means a failure to conform to the theoretical welfare optimum reached at general equilibrium, when of course FMD control is a failure, as is every allocation of every good, that there is a market failure in respect of disease control has by no means been soundly established. This being so, that it is wise to treat stamping out as a public good cannot be safely assumed. We do not want to enter into an argument about what should be done but show how MAFF decided what should be done. And there is, in the light of what actually happened in 2001, not an amusing but a shocking resonance with Coase's critique of Pigou.

In *Wealth and Welfare* of 1912 and in all editions of *Economics of Welfare* up to the fourth and last of 1932, Pigou gave 'the Interstate Railway Commission of the United States' as an example of a public body that would make things better (Pigou,

1932: 334). In one of his most telling jibes, Coase shows that this was merely throwaway; Pigou didn't even get the name right:

> In all editions the Interstate Commerce Commission is referred to as the Interstate Railway Commission, and this body, created in 1887, is always described as 'recently developed,' which does not suggest any real interest in the subject (Coase, 1988: 22).

In essence: 'Pigou never seems to have thought it necessary to inquire whether his optimistic opinion about [this Commission] was justified by events' because he was of a cast of mind that assumed 'the existence of (almost perfectly) functioning public bodies' (*ibid*.).

The way MAFF became committed to stamp out as a response to the 2001 epidemic is not one whit superior to Pigou's reasoning over this Commission. Stamping out works *if* FMD can be quickly detected; *if* it can be quickly localised; *if* infected and at-risk animals can be identified, slaughtered and disposed of quickly; and *if* other appropriate precautionary measures can be quickly put in place. This may happen in a small-scale outbreak. But under MAFF's complacent supervision, everything was put in place to turn a small-scale outbreak into a major one. We have seen that MAFF never did a proper risk assessment of FMD; that the cost-benefit analysis on which its policy was based was not adequate to the weight placed on it and was in many respects obsolete; that MAFF's contingency planning was a paper exercise; that its logistical support therefore was inadequate; and that its response when the disease got out of control was a panicked improvisation. Under MAFF's regulatory gaze, livestock rearing practices, especially mass movement of live animals, which are apt to turn an outbreak into an epidemic were adopted and these reduced MAFF's contingency planning, centered on an epidemiological model which massively underestimated the size of the threat, to absurd blackboard economics.

What can one say about all this other than that, in a most important sense, MAFF did not really have a FMD policy at all prior to the 2001 outbreak? If one had any confidence whatsoever in public law challenges to MAFF's actions, one would argue that those actions were *Wednesbury* irrational (*Associated Provincial Picture Houses v Wednesbury Corporation* [1947] 1 KB 223). But then as the consequences of this failure became manifest, MAFF's behaviour got worse! Stamp out was intended to kill off an outbreak quickly. Persistence in it when it was realised that the outbreak had become epidemic was barbarous. Stamp out could be thought a sensible response to a large-scale outbreak *only* because it was never properly costed for that purpose (the very thing, it will be recalled, MAFF pleads, and the NAO and the PAC accept, is in MAFF's defence).

In addition to all the facts about the nature of the rural economy, what also has changed since 1973 is regulatory *theory*; Power and Harris' 1973 analysis, perhaps excusably, did not even really consider alternatives to direct state governance. It is not excusable that MAFF subsequently continued to simply assume that the stamp out policy and treating disease control as a public good would be the best thing, and took no real pains to confirm whether this was indeed the case. This is to say that MAFF fell far short of the standards of competent current regulatory theory.

In the absence of MAFF doing any of the necessary thinking, the main argument for treating FMD control as a public good is to be found in two unpublished papers by Professor David Harvey of Newcastle University, one written at the height of the epidemic (2001) and one after it (2002). (Being unable to draw on any official arguments, the House of Commons Research Papers which were the principal source of information for concerned MPs during the epidemic (Allen, 2001; Barclay, 2001: 22-26) were largely based on Harvey's work). In these papers, which are the most

sophisticated and honest (if appallingly mistaken in our opinion) welfare economic defence of MAFF's FMD policy of which we are aware, Harvey frankly considered the alternatives and their consequences and concluded that stamp out should be pursued. Estimating the costs of doing nothing about FMD at £1.2 billion *per annum*, and (as he estimated in advance of official estimates) the cost of the 2001 epidemic at £10 billion, he concluded that 'we can afford such an expensive epidemic once every ten years and still come out ahead'. Now, there is much that one can disagree with in Harvey's work even on its own terms; in particular he gives no weight to 'public disgust' against the cruelty mass slaughter without vaccination must involve when, should such a weighting be given a plausible value, it will, as he allows,[12] probably mean vaccination would be inevitable. But arguments of this nature really boil down to lack of confidence in the numbers used in welfare economics, and for present purposes we wish to confine ourselves within the methodology of Harvey's work.

In the absence of the requisite work by MAFF, Harvey was himself basing his estimates largely on Power and Harris' 1973 paper, though he at least attempted to make adjustments to certain of their figures to bring them up to date. Harvey is an academic not a public body and it is hardly his fault if his sometimes heroic adjustments are the best he could do; but it does mean his figures, and the conclusions he reaches on the basis of them, are uncompelling. He himself saw this and in his earlier paper he lamented that: 'the quality of the present debate about the epidemic seems to neatly match the quality of the production and management systems which started it. We can and should do much better than this'; 'one possible benefit of the present crisis is that it might encourage us all to do just that'. The point we are obliged to make is that there is no reason whatsoever based on what has happened over FMD to maintain this optimism, other than a blackboard economics confidence in public

provision of services, which indeed is Harvey's political position on the evidence of his first paper: 'The current and long-running fashion for denying collective responsibility and public service in favour of the worship of individual rights and opportunities is as nasty a virus as the foot and mouth disease itself. We would do well to be rid of both'.

If we may be allowed a personal comment to try to make our position clear: we write as socialists who have repeatedly argued for direct state provision of some goods and the necessity of state involvement in establishing the institutions for the provision of all goods. But whatever sympathy one may have with Harvey's sentiments, his argument exemplifies the weakness in much left-wing economic policy that has allowed the neo-liberal 'fashion' to obtain such a hold. For unacceptably often the virtue of such policy often exists only in the abstract. Certainly, in 2001 public policy took the empirical form of incompetence, irrationality, enormous waste and barbaric cruelty. It was perhaps essential, then, that in his earlier paper, Harvey maintained his position about FMD control as a dogma: that such control should be provided as a public good 'is not a conclusion which depends on empirical evidence. It is a logical consequence of the inherent nature of the phenomenon'.[13]

If we nevertheless try to put Harvey's position to the test by inquiring into at least some of its empirical plausibility, we can see that for his calculation to be compelling, epidemics cannot cost more than £10 billion and/or occur more frequently than every ten years (amongst other conditions). In his earlier paper, Harvey was of the opinion that confidence could be had that these conditions would obtain, indeed, in there being an improvement. The individual cost of future epidemics could be reduced ('we can almost certainly improve the speed of response

and necessary culling') and frequency ('we surely can learn enough from this present catastrophe to avoid such frequent occurrence'). Unfortunately, as he conducted no analysis of the disease control policy formulation process in papers preoccupied with mathematical manipulation of the wholly questionable data, he had no evidence for this whatsoever. His earlier paper indicates some improvements which might be made; his later paper is unable to adduce any reason to think any positive changes are being undertaken. So long as this remains the case, none of the conditions on which his conclusion about stamp out is based can be said to obtain. Harvey does not change his basic opinion about treating disease control as a public good, but he is honest enough to realise that there is no empirical evidence for it:

> Full exploration of the effects of alternative disease control measures, in the context of alternative general farm and rural policies, appears to be what is required for politically and publicly relevant policy analysis and advice. However, we do not have this capacity, and we do not appear to be developing it. To satisfy this requirement, we would need a fully integrated modelling system of the interactions between land use, environment, landscape and wildlife, coupled with a sensible modelling framework of individual and collective behaviours and valuations, embedded in a consistent account of the circular flows of income and expenditures, and, in the case of FMD, a spatial model of disease transmission. No doubt we already have many of the elements of such an integrated understanding of these systems. But, until we attempt to bring these together and test them against observed realities, we are condemned to running such analysis largely in our heads, and thus personalising them and subjecting them to continual contest and argument. The FMD outbreak did not alter any of these circumstances and conditions. It merely highlighted our ignorance and demonstrated our individual and collective lack of public responsibility.

There is no need to attack Harvey's longing for a completely adequate plan of complex systems, the perennial absence of which is the perennial lament of the welfare economist. For Harvey now allows that the UK disease control system cannot even be said to be basically aspiring to rational improvement of its planning function. In our opinion, the only explanation of his own residual commitment to treating FMD control as a public good is his being enmeshed in the blackboard economics of

intervention; in which, it will be recalled, no empirical evidence need be adduced for treating an activity as a public good. Having some idea what happened in 2001, we cannot repeat the winning levity with which Coase made his point, though we wish to apply that point: what was too silly to be said was heard in the cries of thousands of appallingly tortured animals.

As MAFF's reasoning since the 1967 outbreak has not been conducted at as sophisticated or at remotely as honest a level as Harvey's, it is not at all surprising that a disgraceful situation obtained in which the second limb of any adequate argument for intervention over FMD – that government action will improve the situation – was, in fact, appallingly weak. Whilst we are anxious to bring our argument to a halt, to complete it we must say something the horror of the panic slaughter. For by far and away the most important aspect of this disgusting episode is that it must have involved the inhumane slaughter of millions of animals. This was not an accident but rather an inevitable corollary of attempting emergency slaughter on anything like the scale of the contiguous cull. Under the pressure of the volume and haste of slaughter which the contiguous cull required, there was simply no way in which slaughter could have been carried out in accordance with the Welfare of Animals (Slaughter or Killing) Regulations 1995 (S.I.1995/731), and we have, as part of this research, so far assembled scores of reports of animals terrified prior to slaughter, being merely maimed instead of killed outright, being buried and/or incinerated alive, etc.[14] The EUTCFMD was rightly told that this was 'barbaric conduct [which] was a disgrace to humanity' (Uhlig, 2002b). There has been no concerted DEFRA or police investigation of this, and, although the RSPCA investigated over 90 complaints (HMCAG, 2002: 70), there has not, we believe, been a single prosecution.[15] It is not possible to set out what took place briefly in this paper

as, also disgracefully, this mass criminality is downplayed to a very great extent in the official reports, and so an accurate account will have to make extensive reference to primary materials. In future work, we will collate this evidence of mass criminality as part of our argument about the climate of lawlessness which prevailed during the epidemic. For the purposes of this paper we want merely to say that the belief that stamp out ever could be a humane way of dealing with an epidemic (rather than an isolated outbreak) was a most wicked falsehood.

Those who, like ourselves, eat meat in the belief that livestock will be humanely killed must realise that, unless there is radical change, this will not be the case. Animals which provide meat will be killed humanely. But behind them there will inevitably be huge numbers of animals cruelly killed in the occasional panic, mass slaughter which has been the government's response to the epidemic which its disease control policies caused. Fortunately, now that the call for better contingency planning is leading to stamping out being more accurately costed, the EU has concluded that the stamp out policy 'cannot continue in its present form' (EPTCFMD, 2002a: pt. 1, para. 11) and its exclusive use may be abandoned in the UK (HM Government with the Welsh Assembly Government, 2002: 9; cf. Hetherington, 2002). Widespread use of emergency vaccination may improve the handling of the disease and reduce the amount of cruelty because it will probably give the government more time to think before slaughtering and obviate the necessity of slaughter on the 2001 scale. But nothing will solve the problems if current rearing practices, especially the mass movement of live animals, continue unheeding of the risk they create. These practices will always threaten to turn an outbreak into an epidemic because they turn contingency plans into the merest blackboard economics. If those practices are not changed, we are headed for another epidemic even if emergency vaccination is

adopted.[16] And if vaccination is not adopted, stamping out is again bound to decay into mass, cruel slaughter when the next major outbreak occurs. Though exclusive use of stamping out may be abandoned, none of the other questionable practices would appear to be being subjected to sufficiently radical scrutiny; and the consequences of this are all too easy to predict.

SADLY, NOT A CONCLUSION

As this was first drafted, the very practices that caused the epidemic began to be resumed. Movements of live animals were started again, including the cross-channel shipment of live lambs. This not only raises very serious animal welfare problems (Food Ethics Council, 2001: recommendation 14) but obviously constitutes a grave risk which at present the livestock industry ignores.

The 2002 Autumn livestock auctions involved millions of animal movements, and so posed a tremendous risk. DEFRA had announced that it did not intend to lift the 20 day standstill order on livestock movements during the sales. DEFRA had no real choice over this as it has not devised alternative biosecurity measures; but as no alternative policy toward livestock sales has been developed either, the standstill would mean huge disruption of these vital sales and so great losses to the livestock industry. In the now commonplace fashion, the relevant official announcement was preceded by a leak by government, this time through the BBC's *Farming Today* programme broadcast on 30 July 2002.[17] When interviewed on that programme, Robert Forster, Chief Executive of the National Beef Association, showed breathtaking contempt for public opinion by stating that farmers would not observe the standstill, and indeed it was widely ignored (Elliott, 2002). The obvious conflict was avoided because DEFRA, entirely predictably, backed down in all but name,

granting huge numbers of exemptions to the standstill rule. The standstill requirement has now been reduced to 6 days for cattle and sheep, with a view to its complete relaxation (DEFRA, 2003). DEFRA purports to be carrying out cost-benefit analyses to guide its decision about standstill rules (Veterinary Epidemiology and Economics Research Unit, 2003), but as no robust empirical evidence is available about these costs or benefits, the analysis is merely mathematical manipulation largely without data, i.e. a replication of the methodology which produced the disastrous insistence on exclusive use of stamping out in 2001 in the first place.

There have been a number of FMD scares since the epidemic, one of which in particular, which took place in June 2002, involved a situation very reminiscent of the initial outbreaks in 2001. The animals involved *were not tagged* (Connor, 2002), though we have seen that DEFRA's strategy entirely depends upon this happening. The farmer responsible simply disregarded the precautionary measures, and they collapsed; nothing in the MAFF control system prevented this from becoming another epidemic. It has not been possible to trace the farmer responsible (Wilson and Hetherington, 2002), but this is hardly surprising. Experience overwhelmingly tells us that economic regulation based on criminal sanctions is unlikely to work, and that financial incentives are a superior regulatory mechanism. It is a sickening joke[18] that whilst the animals involved in this scare were not tagged, Bobby Waugh *was* tagged as part of his home curfew. Waugh's rearing practices were, as we have noted, certainly appalling, but they were by no means unique and this is fruitless scapegoating. This alarming episode has drawn official criticism from an 'amazed' and 'appalled' government (Connor, 2002), but no solution other than a renewal of faith in the measures which failed in 2001 and, evidently, in 2002, has been put forward (PAC, 2003: paras. 6(viii), 26).

As we not merely continue to look into the pit but resume digging it, it is as well to ask why, and in future papers we will make the remaining two of the three claims we outlined in the introduction to this paper. First, we hope it is now clear that the policies now being adopted, which concentrate on improving contingency planning and pay little or no attention to the creation of risk, are ridiculous in their one-sidedness, and must lead to further blackboard economics errors. We could, let us allow, completely control FMD with sufficient investment in contingency planning, but if hazardous livestock rearing practices continue to run ahead of biosecurity measures, then, unless the disease control budget is infinite, we must fight a losing battle: any measures devised will be reduced to mere blackboard economics out of proportion to the risk posed by rearing practices which undermine those measures. In a subsequent paper we will argue that it was the very treatment of FMD control as a public good that led to livestock rearing practices being devised without rational appreciation of the costs of disease control. These costs may in this way be made external to the livestock rearer and dealer, but they are made external to this group only by being imposed on others.[19] This could happen only because the policy environment of disease control involved lawless action by government on such a scale as to amount to a negation of the basic precepts of the rule of law. In these circumstances, it has seemed not only possible but merely part and parcel of the conduct of government that dealing with FMD could involve immense, cruel slaughter, and the consequential costs of this slaughter be transferred from those causing the risk of harm to other parties. In this paper we have tried to explain the unreasoning confidence in the stamp out policy in terms of its resting on blackboard economics assumptions about its effectiveness. The main question posed by the 2001

epidemic is, however, to understand the nature of the policymaking process that could allow this disastrous policy to obtain (Hood *et al*., 2001).

NOTES

We are grateful to Louise Croker, Tamara Egede and other colleagues in BRASS for their interest in and assistance with this paper, and to Pat Gardiner, Sol Picciotto, Phil Thomas and the editors of this journal and their referees for their comments. Earlier versions of this paper were given to the Annual Conference of the Socio-legal Studies Association, University of Wales at Aberystwyth, April 2002; to the Cardiff Law School, April 2002; to the Centre for the Analysis of Risk and Regulation, LSE, October 2002; to the Faculty of Law, University of West of England, October 2002; to the Nottingham Law School, Nottingham Trent University, October 2002; to the Business School, University of Nottingham, October 2002; to the Cardiff University/Welsh Assembly Forum, December 2002; to the ESRC Centre for Business Research, Cambridge University, February 2003; and to the University of Wales Law Departments' Colloquium, Gregynog, University of Wales, February 2003.

[1] As we shall argue, the epidemiological information available to MAFF was so poor that the numbers of infected animals, and therefore the real size of the epidemic, will never be known with reasonable accuracy. The Countess of Mar may well have been perfectly accurate, then, to doubt whether the 2001 epidemic was the largest outbreak ever known, but to insist nevertheless that 'it was the one in which most animals were killed' (HL Deb, vol 630, col 911, 14 January 2002).

[2] This document, a response 'supported by all departments and agencies of Government', is not attributed to any specific author but presumably was co-ordinated and approved by The Prime Minister's Office. It is an attempt to 'spin' even this story, and its executive summary contains as many falsehoods about MAFF's performance during the epidemic as human ingenuity is able to cram into the space available.

[3] Though we cannot go into the detail of this here, we must point out that, in the context of the Common Agricultural Policy (CAP), it is by no means clear that investing in FMD control to prevent even these losses yields any sort of gain at all. For example: milk production under CAP is subject to heavy direct subsidy and a great volume of dairy produce is simply destroyed. Is there any gain *at all* in maintaining high efficiency in the output of such a product?

[4] We suspect it may have been, in the most important sense, an irrational decision as an important component of post-war FMD policy has been an attempt to maintain a trade barrier against imports even of animal products from countries which do not enjoy FMD free status or are free only by use of vaccination. Under the World Trade Organisation's (WTO) agreement on the Application of Sanitary and Phytosanitary Measures (1994), maintenance of disease-free status without vaccination is a necessary condition of exporting to a number of the most important markets (IDL: ch. 4, Campbell and Lee, 2003a). The most complete history of international FMD control, showing the very important influence of MAFF, is provided by Woods (1999; 2002).

[5] The annual cost of routine prophylactic vaccination in the UK has been estimated at what seems to be the relatively small sum of less than £150 million (IDL: fig 8.2). To

this must, however, be added the costs of lost exports because of WTO trading restrictions (n. 4 above). Harvey (2001: table 1) puts these costs at *circa* £500 million *per annum*. These costs are a major part of the reason that FMD is regarded as an economically important disease. Leaving aside possible objections to this figure, it follows from the WTO's trade policy, and, therefore, from a theoretical if not immediately practical perspective, the circularity of using it to establish that policy is manifest (as Harvey allows).

[6] COBR is also known by the acronym COBRA as the room in question is Briefing Room A.

[7] For this reason, the 'contiguous' and the '3 kilometre' culls are strongly distinguished in some discussions of the epidemic. We follow the predominant usage by normally referring to both as the contiguous cull.

[8] This statement by the Secretary of State was made on the date the *Lessons to Be Learned* inquiry reported. Prior to this, it is fair to say that the government had largely publicly celebrated MAFF's performance: see n. 2 above.

[9] Even the use of 'unprecedented' is not unprecedented: exactly this excuse was accepted by the official inquiries into the 2 largest previous UK epidemics (LTBL: 23). Though we cannot go into this here, Woods' (2002) history of twentieth century FMD control shows almost every aspect of the 2001 epidemic to have been present in these earlier epidemics, the principal difference being in the orders of magnitude of slaughter.

[10] Behind the sheer volume of animal movements lies the issue of the intensity of livestock rearing, for it is a highly plausible hypothesis that, given the nature of the FMD virus, the risk of FMD will vary directly with that intensity (European

Parliament, 2002a: 46). This would seem to be supported by analysis of the 1967 epidemic which has shown that only 1% of dairy herds with less than 10 cows were infected, in contrast with 29% of herds of over 80 cows: IDL (para. 3.5). We shall not go into this here, though that cattle herd and sheep flock sizes have far more than doubled since 1967 (LTBL: 26) obviously is worrying.

[11] A possibly relevant EU document (European Commission, 1989) is not available to the general public and we have been unable to obtain a copy.

[12] Power and Harris (1973: 594) allowed this but in a much more limited respect, of 'the cost to farmers of greater uncertainty and stress under the slaughter policy'.

[13] Harvey's 'logical' approach to the identification of a public good cannot survive Coase's (1988, 187-213) critique of the way the lighthouse was used as an axiomatic example of such a good, which both destroyed that logic and, in a characteristic Coase touch, showed that in fact there was a perfectly thriving private market in British lighthouse services prior to 1842, which was ended only by the state buying the private lighthouses at enormous expense!

[14] One example – by no means the most harrowing of which we are aware, for these are not easily printable - will suffice here. The following is a report of an interview by Mr Nick Green (2002), a Cumbrian environmental activist, of a vet working at the Great Orton disposal site:

> Once again, imagine you were helping to kill literally thousands of healthy lambs daily. Little lambs, petrified and calling out in desperation for their mothers, who had probably already fallen to the captive bolt gun and pithing rod. Sadly, these lambs would not be allowed this easy route. You see, lambs are hard to kill. They have very soft skulls and the captive bolt gun, used under the orders of the veterinary surgeons, do not kill the lambs. It simply compresses, viciously, their skulls and tears apart their lower jaw. They do not die, they are still very much alive and are thrown down to join the ever growing pile of wriggling, suffering and terribly frightened little animals. They then had to be pithed to kill them and in

> some cases were also “vented” [had their throats cut]. Imagine holding a day old lamb. Imagine a Spanish [temporary vet], barely able to talk English. Imagine this vet attempting to administer a needle into the heart of this little creature. The lambs were never sedated. Imagine having to hold this little thing whilst our vet has five attempts at killing this lamb. Imagine seeing four broken needles sticking from the chest of this animal.

This report, and a very great deal of material to similar effect, is posted at www.warmwell.com

[15] A prosecution was mounted in Cardiff in September 2002. The ghastly facts were that a slaughterman was taking multiple pot shots at animals from distance (Hall, 2002). This slaughterman was acquitted of offences under the Health and Safety at Work Act 1974 (the risk being that of possible harm to humans from ricochets!) but his employing local authority was convicted and fined £100,000.

[16] This was argued throughout the epidemic by Farmers for Action, a campaign group organised by farmers opposed to the NFU’s slaughter policy and, indeed, to the NFU itself: www.fmdaction.il2.com. By no means all sections of the NFU agreed with the national line, with Mr Anthony Gibson, South West Regional Director, being a particularly forceful advocate of vaccination.

[17] We are grateful to the BBC for supplying a tape of this programme.

[18] Made by the Editor of the *Independent* who ran the relevant news items together on the front page.

[19] In the aftermath of the 2000 outbreak of classical swine fever, MAFF did form a working party to discuss the use of private insurance in disease control (MAFF, 2000). We have been unable to find any results of the deliberations of this working party, but it appears that those deliberations are continuing (Curry, 2002: 37-8; Committee of Public Accounts, 2003: para. 36).

BIBLIOGRAPHY

Allen, G. (2001) Economic Indicators. House of Commons Library Research Paper 01/42.

Anderson, I. (2002) Foot and Mouth Disease 2001: Lessons to be Learned Inquiry Report. London, Stationery Office.

Anon. (2001) Outcry Over Unnecessary Slaughter. Guardian, 11 May.

Ayres, I. and J. Braithwaite (1992) Responsive Regulation. Oxford, Oxford University Press.

Barclay, C. (2001) Foot and Mouth Disease. House of Commons Library Research Paper 01/35.

Beat, A. (n.d.) Professor of Mythology www.warmwell.cm

Bennett, R. *et al* (2000) Economic Valuation of Farm Animal Welfare Policy: Baseline Study and Framework Development. Reading: Veterinary Epidemiology and Economics Research Unit, Department of Agricultural and Food Economics, University of Reading.

Berentson, P.B.M. *et al*. (1992) A Critique of Published Cost-benefit Analyses of Foot and Mouth Disease. Preventive Veterinary Medicine, 12:217

Bourbakis, M. and J. Allinson (2001-2) *The Aftermath of the Foot and Mouth Crisis in Agricultural Logistics: The Case of the UK Fat Lamb Chain*. Centre for Rural Economy, University of Newcastle.

Button, K. and D. Swann (eds) (1989) The Age of Regulatory Reform. Oxford, Clarendon Press.

Campbell, D. and Lee, R. (2003a) The Foot and Mouth Outbreak 2001 and the Limits of Legality. Paper, SLSA Conference, Nottingham

Campbell, D. and Lee, R. [2003b] The Power to Panic: The Animal Health Act 2002. Public Law, 372.

Clover, C. and S. Beswick (2001) Foot and Mouth Epidemic is World's Worst. Daily Telegraph, 4 September.

Coase, R.H. (1964) The Regulated Industries: Discussion. American Economic Review (Papers and Proceedings), 54: 192.

Coase, R.H. (1988) The Firm, the Market and the Law. Chicago, University of Chicago Press.

Committee of Public Accounts (PAC) (2003) The 2001 Outbreak of Foot and Mouth Disease. H.C. (2002-03) 487.

Committee on Church and Nation (2001) Proposal to Introduce a 20 Day Standstill Period following Movements of Sheep and Cattle. Edinburgh, Church of Scotland.

Connor, S. (2002) Scandal of the Untagged Pig. The Independent, 19 June.

Cowan, R. (2001) Dealer Seeks Amnesty for Help in Tracing Infected Sheep. Guardian, 13 March.

Cumbria Foot and Mouth Disease Inquiry Panel (2002) Cumbria Foot and Mouth Disease Inquiry Report. Carlisle, Cumbria FMD Group and Cumbria County Council.

Curry, D. (2002) Policy Commission on the Future of Farming and Food Farming and Food. London, Cabinet Office.

Department of Environment, Food and Rural Affairs (DEFRA) (2001) Bovine Spongiform Encelphalopathy: A Progress Report. London, DEFRA.

DEFRA (2002a) Autumn Performance Report 2002, Cm 5698.

DEFRA (2002b) Foot and Mouth Contingency Plan, London, DEFRA.

DEFRA (2002c) Illegal Imports Action Plan 2002-3. London, DEFRA.

DEFRA (2002d) News Release: Statement by Secretary of Margaret Beckett on the Government Response to the FMD Inquiry Reports, 6 November.

DEFRA (2003) Interim Animal Movements Spring 2003: Written Ministerial Statement of 23 January.

DEFRA (2002e) Origin of the UK FMD Epidemic in 2001. London, DEFRA.

DEFRA/Department of Culture, Media and Sport (DCMS) (2002) Economic Cost of Foot and Mouth Disease in the UK, London, DEFRA.

Donaldson, A.I and T.R. Doel (1992) Foot and Mouth Disease: The Risk for Great Britain after 1992. Veterinary Record, 131: 114.

Donaldson, A.I. *et al*. (2001) Relative Risks of Uncontrollable (Airborne) Spread of FMD by Different Species. Veterinary Record, 148: 602.

Donaldson, A.I. and Alexandersen, S. (2002) Predicting the Spread of Foot and Mouth Disease by Airborne Virus. Science and Technical Review 21(3): 569

Doyle, P. (2001) The Foot and Mouth Inquiry News Summary. Devon County Council Media Service, 12 October.

Drummond, R.O. (1999) A Report of a Study of Notifiable Disease Preparedness with the SVS. London, MAFF.

Elliott, V. (2001) £900 Sale of Sheep Led to Rapid Outbreak. Times, 27 February.

Elliott, V. (2002) Farmers Defy "Silly" Rules to Curb Animal Disease. Times, 17 October.

European Commission (1989) Report from the Commission to the Council on a Study Carried Out by the Commission on Policies Currently Applied by Member States in the Control of Foot and Mouth Disease. SEC (89) 1731 final.

European Commission (1991) Recommendations or Guidelines for Contingency Plans against Foot and Mouth Disease. DGVI/1324/9.

European Commission (2001) EU Policy on Vaccination Against Foot and Mouth Disease. March 2001.

European Parliament Temporary Committee on Foot and Mouth Disease (EPTCFMD) (2002a) Foot and Mouth Disease. Final Report, 2002/2153(INI).

EPTCFMD (2002b) Questions to Representatives and Former Representatives of the U.K. Government etc. March 26 and April 8, 2002

Food Ethics Council (2001) After FMD: Aiming for a Values-driven Agriculture. London, Food Ethics Council.

Food Standards Agency (2002) Press Release: Vigilance of Meat Hygiene Service Led to Discovery of Foot and Mouth Disease. 23 February.

Food Standards Agency (2001) Statement on Food and Mouth Disease. Food Standards Agency, 22 February.

Green, N. (2002) Well, We Know Who Didn't Kill Billy the Bull, etc. www.warmwell.com.

Gillan, A. (2001) Panic Felt Across the West Country. Guardian, 27 February.

Habermas, J. (1976) Legitimation Crisis. London, Heinemann.

Hall, S. (2002) Slaughterman Fired on Sheep "Willy-nilly". Guardian, 2 October.

Harvey, D. (2001) What Lessons from Foot and Mouth? A Preliminary Economic Assessment of the 2001 Epidemic. Centre for Rural Economy Working Paper 63, University of Newcastle.

Harvey, D. (2002) Practical Welfare Analysis: Conception, Interpretation and Implications. The Case of Foot and Mouth Disease. Department of Agricultural Economics and Food Marketing, University of Newcastle.

Hawkins, K. (1984) Environment and Enforcement. Oxford, Clarendon Press.

Herbert, I. (2002) While Guilty Farmer is Tagged. Independent, 19 June.

HM Comptroller and Auditor General (HMCAG), (2002) The 2001 Outbreak of Foot and Mouth. HC (2001-2) 939.

HM Government (2002) Government Memorandum Addressing Issues Raised in the Framework Document of the Lessons to be Learned Inquiry. March http://www.defra.gov.uk/corporate/inquiries/index.asp

HM Government with the Welsh Assembly Government (2002) Response to the Reports of the Foot and Mouth Disease Inquiries. Cm 5637.

Hetherington, P.(2002) Beckett Vows to Vaccinate in any Future Foot and Mouth Outbreak. Guardian, 7 November.

Highfield, R. (2001) Tactics Used on Half the Farms "Were Inefficient". Daily Telegraph, 22 May.

Hood, C. *et al*. (2001) *The Government of Risk*. Oxford, Oxford University Press.

Houghton Brown, M. (2001) Inoculate – Don't Prevaricate. Times, 17 March.

Kennard, R. and R. Young (1999) The Threat to Organic Meat from Increased Inspection Charges. Bristol, Soil Association Report.

King, D. (2002) Lecture to the Royal Society. 12 November.

Kitching, P. (2001) Interview by Channel 4 News. 21 April (www.sovereignty.org.uk/features/footnmouth/pkinter.html)

Kitching, P. (2002) Submission to the European Parliament Temporary Committee on Foot and Mouth Disease. July 16 (www.europarl.eu.int/comparl/tempcom/fiap/meetings/20020716/kitching_background_en.pdf)

Leforban, Y. (1999) Prevention Measures Against Foot and Mouth Disease in Europe in Recent Years. Vaccine. 17:1755

Lucas, C. (2001) Stopping the Great Food Swap; Re-localising Europe's Food Supply. Strasbourg, Greens/European Free Alliance.

Majone, G. (1994) The Rise of Regulatory State in Europe. West European Politics, 17: 77.

Mercer, I. (2002) Crisis and Opportunity: Final Report of the Devon Foot and Mouth Inquiry. Tiverton, Devon Books.

Ministry of Agriculture, Fisheries and Food (MAFF) (2000) Joint MAFF/Industry Working Party to Review the Commercial Impact of Animal Disease Controls. www.defra.gov.uk/animalh/diseases/impact.htm

Nonet, P. and P. Selznick (2001) Law and Society in Transition. New Brunswick, N.J., Transaction Books.

Office International des Epizooties (O.I.E) (2000) Manual of Standards for Diagnostic Tests and Vaccines, 4th. edn. Paris, O.I.E.

O.I.E. (2002a) International Animal Health Code, 10th. edn. Paris, O.I.E.

O.I.E. (2002b) List of FMD-free Countries www.oie.int/eng/info/en_fmd.htm

Lord Phillips (Chair) (2000) The Inquiry into BSE and Variant CJD in the UK, HMSO.

Pigou, A.C. (1932) Economics of Welfare, London, Macmillan.

Pluimers, F. H. *et al*. (2002) Lessons from the Foot and Mouth Disease Outbreak in the Netherlands in 2001. Science and Technical Review 21(3): 711.

Power, A.P. and S.A. Harris (1973) A Cost-benefit Analysis of Alternative Control Policies for Foot and Mouth Disease in Great Britain. Journal of Agricultural Economics 24: 573.

Prempeh, H. *et al*. (2001) Foot and Mouth Disease: The Human Consequences. British Medical Journal 322: 565 (10 March).

Prescott, M. and J. Leake (2001) Ministers Hit Out at Farmers. Sunday Times, 25 March.

Roberts, D. (2001) Rural Change and the Impact of Foot and Mouth Disease', Countryside Recreation 9: 4.

Robertson, C. (2002) Slaughter Toll Three Times the Official Figures. Sunday Post, 20 January.

The Royal Society (2002) Infectious Diseases in Livestock, Policy Document 19/02. London, The Royal Society.

Rushton, J. *et al*. (2002) Economic Analysis of Vaccination Strategies for Foot and Mouth Disease in the UK. Reading: Veterinary Epidemiology and Economics Research Unit, Department of Agricultural and Food Economics, University of Reading.

Secretary of State for Environment, Food and Rural Affairs (2002) Statement on Foot and Mouth Inquiries. 22 July.

Select Committee on Environment, Food and Rural Affairs (2002) The Impact of Foot and Mouth Disease, First Report. HC (2001-2) 323.

Shannon, D. (2002) Not Like This. Science and Public Affairs, 6 (February).

Shaoul, J.E. (1997) Mad Cow Disease: The Meat Industry is Out of Control. The Ecologist, 27(5): 182.

Sheenan, M. and V. Kearney (2001) Gardai Quiz Dealer on Outbreak. Sunday Times, 4 March.

Studd, H. (2001) Foot and Mouth at Essex Farm Complex. Times, 21 February.

Sunstein, C. (1990) After the Rights Revolution: Reconceiving the Regulatory State. Cambridge, Mass., Harvard University Press.

Teubner, G. (1993) Law as an Autopoietic System. Oxford, Blackwell.

Uhlig, R. (2002a) Ten Million Animals Were Slaughtered in Foot and Mouth Cull. Daily Telegraph, 23 January.

Uhlig, R. (2002b) Foot and Mouth Cull "Was Barbaric". Daily Telegraph, 19 June.

Uhlig, R. (2002c) Foot and Mouth Computer Data was Inadequate. Daily Telegraph, 17 July.

Uhlig, R. (2002d) Foot and Mouth Warning by State Vets Ignored. Daily Telegraph, 21 July.

Veterinary Epidemiology and Economics Research Unit (2003) *FMD: Animal Movements Regime – CBA*. Reading, Veterinary Epidemiology and Economics Research Unit, School of Agriculture, Policy and Development, University of Reading.

Vidal, J. and P. Brown. (2001) Police Check "Illegal" Livestock Movements. Guardian, 11 April.

Wainwright, M. (2002) Foot and Mouth Farmer in Cruelty Case. Guardian, 8 May.

Wilson, J. and Hetherington, P. (2002) Foot and Mouth Risk Pig Could Not be Identified. Guardian, 29 June.

Windsor, R. (2001) Address to the Council of the Royal College of Veterinary Surgeons. 6 June www.warmwell.com.

Woods. A. (n.d.) Foot and Mouth Disease: An Evaluation of the Current Control Policy from an Historical Perspective. Hamstead Marshal, Elm Farm Research Centre www.efrc.com/fmd/fmdtext/fmdhistory.pdf.

Woods, A. (1999) *From Occupational Hazard to Animal Plague: Foot and Mouth Disease in Britain 1839-1884*. MSc, Manchester University.

Woods, A. (2002) *Foot and Mouth Disease in Twentieth Century Britain*. PhD, Manchester University.