

Institution: University of Kent		
Unit of Assessment: 16: Economics and Econometrics		
Title of case study: Enhancing Defra's Analytical Capacity to Assess the Economic Impact of a Notifiable Disease Outbreak		
Period when the underpinning research was undertaken: 2006-2011		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Robert Fraser	Professor	2006-2015
Period when the claimed impact occurred: 2014-2020		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact The framework for analysing consumer and producer impacts of exotic disease outbreaks, which was developed by Cook and Fraser (2008), catalysed the development of the Rapid Appraisal Technique by Fraser in the School of Economics at the University of Kent, which enables a quick <i>ex ante</i> assessment of the economic impact of disease outbreaks. This technique was adopted by the Department for Environment, Food and Rural Affairs (Defra), helping Defra to take a pragmatic approach to the economic analysis of the Avian Influenza outbreak in 2014. Subsequently, Fraser's research supported Defra to begin work on expected costs of future outbreaks, enabling the estimation of the monetary value of trade-related costs of such outbreaks. Fraser's impact on Defra to address disease outbreaks continues, and in 2020 he proposed exploring the incentives of bovine TB-affected farmers to apply on-farm biosecurity measures and early reporting of outbreaks.		
2. Underpinning research Article 5 of the World Trade Organization (WTO) Sanitary and Phytosanitary (SPS) Agreement identifies the factors considered relevant from a WTO perspective in assessing the extent of quarantine risks, and typically involves either quantitative or qualitative assessments of possible invasive species impacts. Omitted from this list of relevant factors, however, are consumer gains from trade, and typically neither producer nor consumer impacts are evaluated in terms of changes in producer and consumer surplus by the WTO's Dispute Resolution Panel. This is problematic for a proper assessment of the relative benefits and costs of a trade decision, as the benefit side of the ledger is effectively missing, and there is no analysis of economic impacts. Specifically, in considering a proposal to allow imports of a product, analytical models informing a decision should reconcile the net benefits of trade with the potential costs to domestic production of an outbreak of invasive species associated with trade to establish the welfare maximising outcome. As a consequence of these limitations, Cook and Fraser [R1] developed a framework for analysing trade disputes which can evaluate both the potential gains from trade (combining changes in producer and consumer surplus) and the potential costs associated with the risk of an invasive species introduction. In this way, economic analysis can determine if the net benefits of imports are likely to exceed the quantifiable increase in pest damage risk, and therefore if trade will result in a net gain to society. If not, prohibition is justified on the grounds that it will prevent a net social welfare loss. [R1] thus established a theoretical framework, previously absent from the literature, to assess the economic impact of alternative policy options to tackle the introduction of invasive species, that takes account of the welfare		

gains and losses resulting from trade restrictions. This theoretical framework was subsequently used in empirical research to evaluate the trade dispute regarding imports of New Zealand apples into Australia [R2], which illustrated its potential usefulness as a framework for also empirically evaluating the economic impact of disease outbreaks, based on the impact of such outbreaks on exports, imports, and associated domestic markets.

Fraser realised that [R1] can also provide the basis for an analytical framework for a rapid assessment of the economic impacts of animal disease outbreaks to determine the optimal policy response. In 2014, Fraser was appointed to the Science Advisory Council's Exotic Diseases Sub-Group (SAC-ED) as the sole economist on the Sub-Group. The Science Advisory Council (SAC) provides independent advice on science policy and strategy to the Department for Environment Food and Rural Affairs (Defra). Defra is responsible for responding to disease outbreaks in England (the responsibility for animal health is transferred to the devolved administrations of the UK constituent countries). Within the context of his appointment to SAC-ED, Fraser developed an applied technique for rapid *ex ante* appraisal of the economic consequences of an animal disease outbreak, using a semi-quantitative assessment of the economic impacts identified in [R1]. The policy impact of Fraser's development of this technique provides the foundation for this impact case study.

Addressing the risk of animal disease outbreaks requires farmers to adopt appropriate on-farm biosecurity measures and early reporting of disease outbreaks on their farms. Governments compensate farmers for financial losses, which improves compliance with disease-reporting requirements, but attenuates the incentives to adopt *ex ante* biosecurity measures. While previous research had recognised this problem, an analytical framework to determine the level of compensation was lacking. In [R3], Fraser developed a framework to determine a range of compensation payments that incentivise both necessary farmer actions.

3. References to the research

[R1] Cook, D., and Fraser, R. W. (2008). 'Trade and invasive species risk mitigation: reconciling WTO compliance with maximising the gains from trade', *Food Policy* 33(2), pp. 176-84. doi: <https://doi.org/10.1016/j.foodpol.2007.07.001>

[R2] Cook, D., Fraser, R. W., Carrasco, L., and Paini, D. (2011). 'Estimating the social welfare effects of New Zealand apple imports', *Australian Journal of Agricultural and Resource Economics* 55(4), pp. 599-620. <https://doi.org/10.1111/j.1467-8489.2011.00558.x>

[R3] Fraser, R. W. (2018). 'Compensation payments and animal disease: incentivising farmers both to undertake costly on-farm biosecurity and to comply with disease reporting requirements'. *Environmental and Resource Economics* 70(3): 617-629. <https://doi.org/10.1007/s10640-016-0102-7>

4. Details of the impact

There are 42 notifiable animal diseases in the UK that pose significant risks for public health, livelihoods, and the character of the UK's landscape. The UK contingency plan for exotic notifiable diseases of animals underlines that they 'present a significant threat to farming, to rural communities, to animal keepers and to the economy as a whole', and there is a shared interest in a rapid response. Outbreaks can impose severe monetary costs, exemplified by the foot-and-mouth outbreak in 2001, which cost the UK economy £2-3 billion. Defra's Science Advisory Council, and the Sub-Group on exotic diseases (SAC-ED), advises Government Ministers and senior policy-makers on their response to outbreaks, which can range from active measures (culling of animals, export bans, etc.) to longer-term actions such as periodic risk assessments.

In 2014, Fraser was appointed to SAC-ED, as the sole economist on the group. Fraser's work as a member of SAC-ED coincided with a major outbreak of Avian Influenza (HPAI H5N8)

among the UK's poultry industry in 2014, which required a swift and substantial reaction from Defra to contain the outbreak. In discussions between SAC-ED and Defra, it became clear that while Defra had a clear sense of how to manage the outbreak, they had no analytical framework for quickly evaluating the economic impacts of such an outbreak [c], although the impacts were likely to be substantial, and an assessment of their magnitude would be required in a policy context.

Developing an appraisal technique for Defra

Fraser realised that the framework developed in Cook and Fraser (2008) could be adapted to the situation of an actual exotic disease outbreak, and modified it using a semi-quantitative assessment approach, to develop a Rapid Appraisal Technique for assessing the economic impact of a notifiable disease outbreak. He suggested the advantages of this development to SAC-ED. This suggestion was endorsed by SAC-ED at a meeting on 26 November 2014: 'SAC-ED welcomed the overview of the economic analysis undertaken by Defra. The committee noted the challenges in producing reliable models of the economic impact of the outbreak and suggested that Defra consider the use of rapid appraisal techniques. Rob Fraser is willing to engage with Defra on this issue.' [a] Following this suggestion, Fraser, in his capacity as a member of SAC-ED, developed a 'Rapid Appraisal Technique for Assessing the Economic Impact of a Notifiable Disease Outbreak' [c].

Making use of internal Defra evaluations of the components of the economic costs of disease outbreaks, Fraser's technique is focused entirely on the trade-related consequences of a disease outbreak, and, combined with its semi-quantitative approach, is suitable for quickly assessing the likely scale of the economic impact of an outbreak of a disease which can result in the temporary closure of export markets for host products. Based on the key components of the theoretical framework presented in [R1], the technique produces a rapid assessment of the potential scale of the disruption to the normal patterns of production and sale of host products arising from the export ban, as well as of the potential for import substitution to provide an outlet for banned exports of host products, combined with the likely reaction of domestic consumers to the disease outbreak. As such, the technique comprises three main components:

1. An assessment of the potential scale of the disruption to the normal patterns of production and sale of host products arising from the export ban;
2. An assessment of the potential for import substitution to provide an outlet for banned exports of host products;
3. An assessment of whether negative effects on domestic consumer demand for host products are likely because of the outbreak.

The successful application of the appraisal technique

An application of the technique to the case of the Avian Influenza outbreak revealed that the scale of the economic costs was small, 'thus clarifying the focus of Defra's response to the outbreak' [c]. Following this development, Defra's response to SAC-ED stated that 'Professor Rob Fraser's paper on "Rapid Appraisal Technique for Assessing the Economic Impact of a Notifiable Disease Outbreak" was helpful in taking a pragmatic approach to the economic analysis of the [Avian Influenza] outbreak' [b].

Based on the approach taken in the appraisal technique, Defra began work to estimate the expected costs of future disease outbreaks in collaboration with Fraser. One of the first estimates based on this work indicated that an African Swine Fever outbreak in the UK would have trade-related costs of £40 million (Defra previously lacked an analytical framework for a quick assessment of these costs) out of total expected costs of £45 million [c].

The Rapid Appraisal Technique, and the framework for evaluating the expected cost of future outbreaks, have since become part of Defra's analytical capacity for evaluating any new

animal disease outbreak in the UK [c]. The approach was also applied in Defra's Monthly Biosecurity Meetings with the Secretary of State between 2014 and 2015, in discussions on how to tackle the invasion of non-native species (e.g. killer shrimp) and tree health outbreaks [d].

In 2018, Fraser was appointed as one of five core members of Defra's Economic Advisory Panel, and in this context was 'paired' with Nancy Race, Defra's Senior Economic Advisor for Animal Health, in order to provide external advice on the economic impact of animal disease outbreaks, among other policy-related matters. Nancy Race confirmed that Defra has 'made extensive use of this work [on the expected cost of future disease outbreaks] in various business cases and impact assessments'. She further stated that Fraser's work on the expected cost of future outbreaks is providing the basis for discussions about 'a prioritisation model which will be used to determine which diseases Government should focus on'. [c]

As a member of the Economic Advisory Panel, Fraser continued (up to the end of 2020) to advise Defra on animal disease outbreaks, including analysis 'to better understand the incentives of Bovine TB-affected farmers to undertake risk-reducing behaviour' [e]. In this context, the analytical framework developed in [R3] 'has resonated strongly across the Defra analytical team'. [e]

5. Sources to corroborate the impact (indicative maximum of 10 references)

[a] Sciences Advisory Council Meeting (SAC Sub-Group on Exotic Diseases) on HPAI H5N8. The meeting took place on 26 November 2014. Professor Fraser was present at the meeting (p. 6), and his willingness to engage with Defra on the development of a Rapid Appraisal Technique is mentioned in key points from this meeting (pp. 4, 6, 7). (The evidence is also available as a pdf.)

[b] Defra response to the key points from the meeting on 26 November 2014 to consider HPAI H5N8. The reference to Fraser is on p. 4. (The evidence is also available as a pdf.)

[c] Email from the Head of Defra's Animal and Plant Health and Welfare Analysis to the Head of the University of Kent's School of Economics regarding Professor Fraser's impact on Defra's analytical capacity and policy-related activities in the area of animal disease outbreaks, 3 February 2021.

[d] Email from the Strategy Adviser to Defra's Secretary of State to the Head of the University of Kent's School of Economics regarding Professor Fraser's impact on Monthly Biosecurity Meetings with the Secretary of State, 20 February 2020.

[e] Email from the Economic Advisor in Defra's Animal and Plant Health and Welfare Directorate to the Head of School of Economics at the University of Kent regarding Fraser's advice to Defra on the design of incentives for farmers affected by animal disease outbreaks.