Webinar

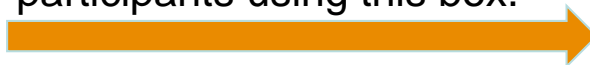**Welcome! We will begin at 12.30 CET**

Before the webinar begins, you can check that your sound is working by selecting 'Meeting' and 'Audio Setup Wizard' and following the on-screen instructions. You don't need to set up a microphone.

If you have any problems, please use the chat box to ask for our help. You can also say hello to your fellow participants using this box.

Agenda

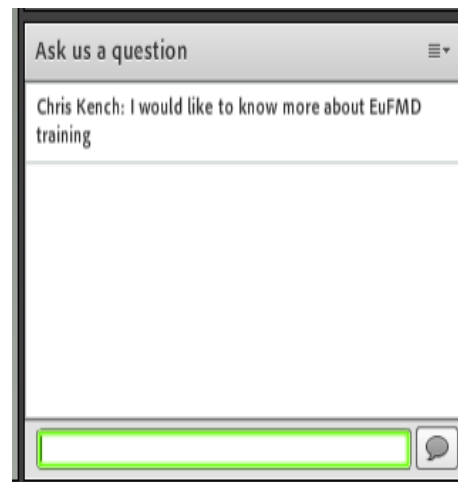1. **How to use the webinar screen**

2. **Technical presentation:**

Dr Siyi Feng

Market Impact of Foot-and-Mouth Disease Control Strategies: A UK Case Study

We will be recording the webinar

Introduction to the webinar screen

Ask us a question

Chris Kench: I would like to know more about EuFMD training

Who is listening?
(Please choose the best answer):

➢ University-based

➢ Government Veterinary (contingency planning, epidemiology)

➢ Laboratory scientist

➢ Field veterinarian

➢ International organization

➢ Other

EuFMD Networks *(join at https://eufmdlearning.works/)*
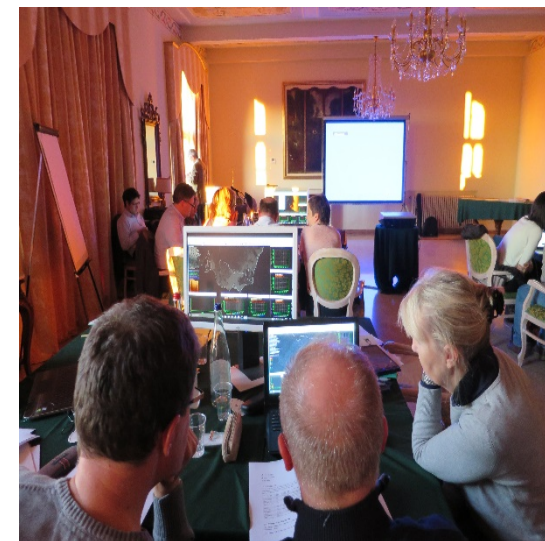
Modelling

Contingency planning

Vaccination

Biorisk Management

Progressive Control Practitioners

EuFMD News

Southern Italy

Modeling network news

Upcoming webinars in 2018:

- Rowland Kao (UK)

- Thomas Rawdon (NZ)

*Remember the **recordings** are available on the e-learning site, as well as the **discussion forum** and **model inventory!***

Any questions? Contact us:

eufmd-training@fao.org,

Market Impact of Foot-and-Mouth Disease Control Strategies: A UK Case Study

Presentation to EuFMD Modelling network
7 December 2017

Siyi Feng, Myles Patton and John Davis, AFBI

Poll question 1

- **Have you collaborated with economists in your previous research?**

- **Answer:**
  - **Yes**
  - **No**

Acknowledgement

- **Thanks to Animal and Plant Health Agency (APHA) of the UK for providing outputs from EXODIS epidemiology model**

- **We are very grateful for the comments given by Ann Seitzinger and Amy Hagerman from the Center for Epidemiology and Animal Health at USDA and Jonathan Rushton at University of Liverpool**
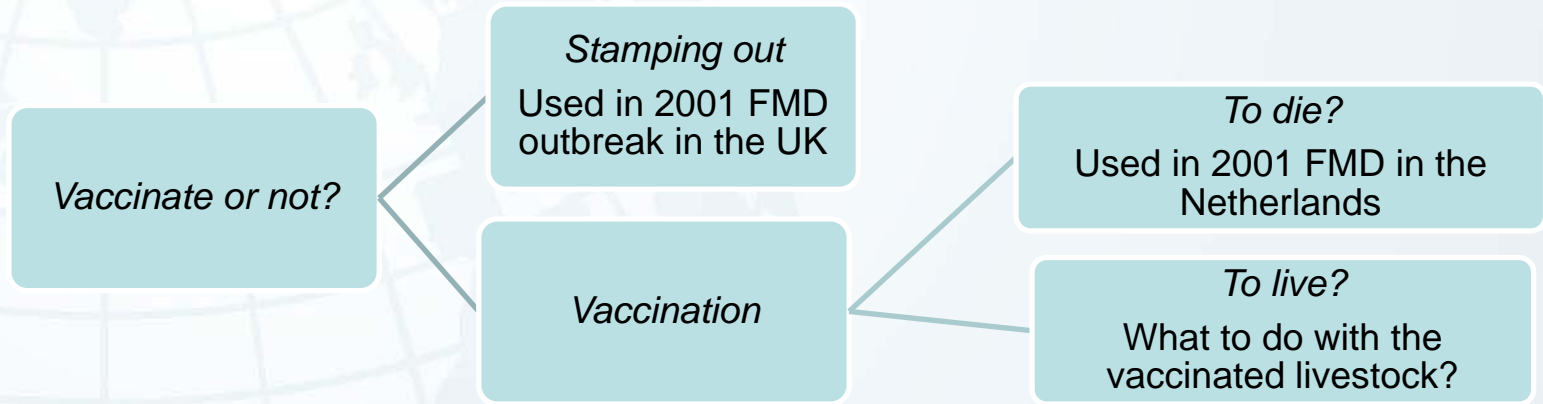
Overview

- **Introduction**

- **Scenarios and Model**

- **Results**

- **Sensitivity Analysis**

- **Conclusions**

INTRODUCTION

Introduction

- FMD control strategies and their evaluation

```
┌─────────────────────┐        ┌─────────────────────────┐
│                     │────────│ Stamping out            │
│                     │        │ Used in 2001 FMD        │
│  Vaccinate or not?  │        │ outbreak in the UK      │        ┌──────────────────────────┐
│                     │        └─────────────────────────┘────────│ To die?                  │
│                     │                                            │ Used in 2001 FMD in the  │
└─────────────────────┘        ┌─────────────────────────┐        │ Netherlands              │
                               │                         │        └──────────────────────────┘
                               │      Vaccination        │
                               │                         │        ┌──────────────────────────┐
                               │                         │────────│ To live?                 │
                               └─────────────────────────┘        │ What to do with the      │
                                                                  │ vaccinated livestock?    │
                                                                  └──────────────────────────┘
```

- Evaluations often just based on Benefit-Cost framework
  - ➤ Provides detailed information on changes in profit for a farm or government budget implications

- BUT cannot capture market impacts
  - ➤ Partial equilibrium models can contribute to evaluation process
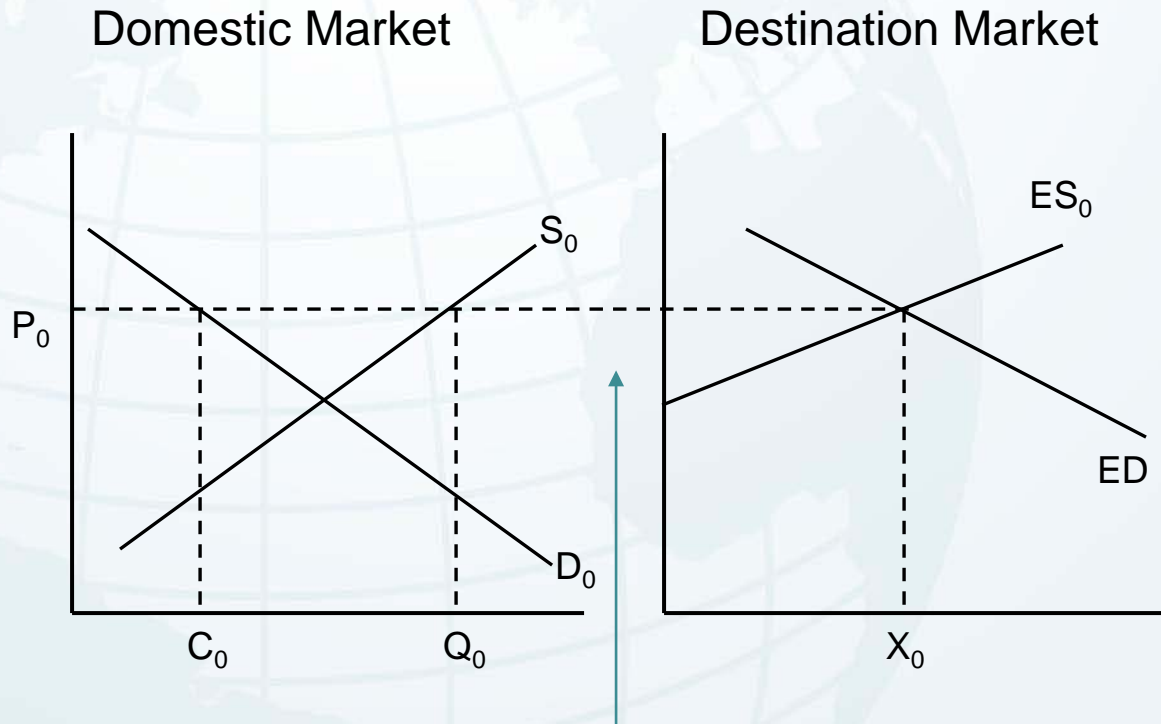
Possible Market Impacts of FMD Outbreak
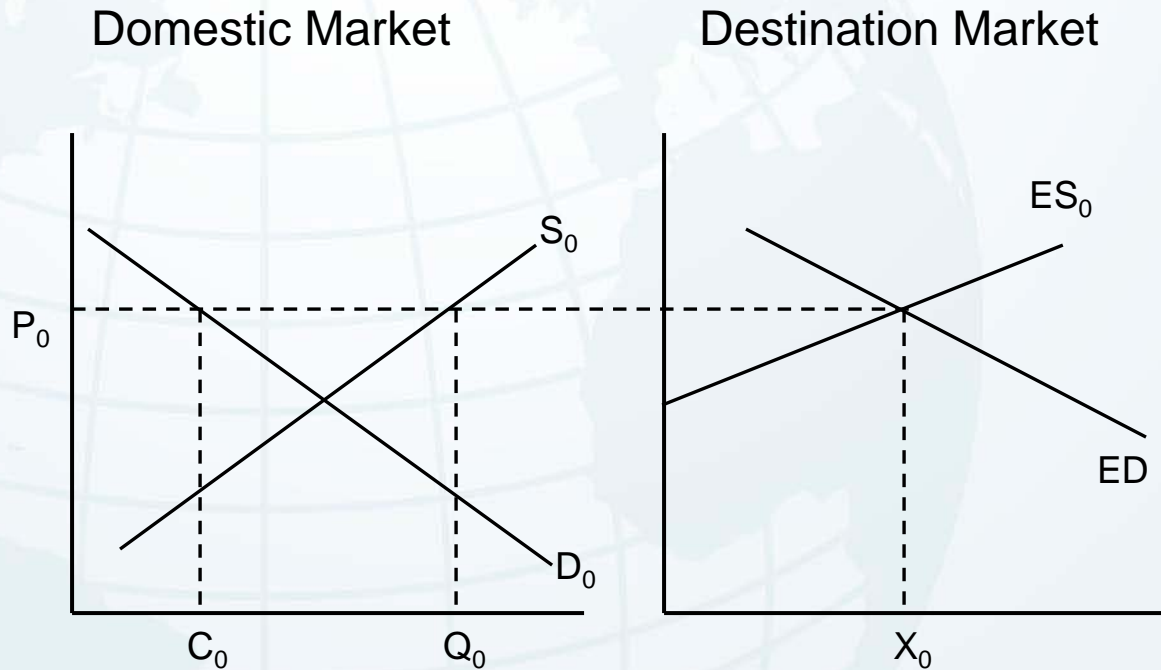
Domestic Market

Destination Market

Prior to Outbreak

- Difference between supply & demand in the domestic market, yields quantity available for export (ES_0)

- Foreign demand for meat shown by ED
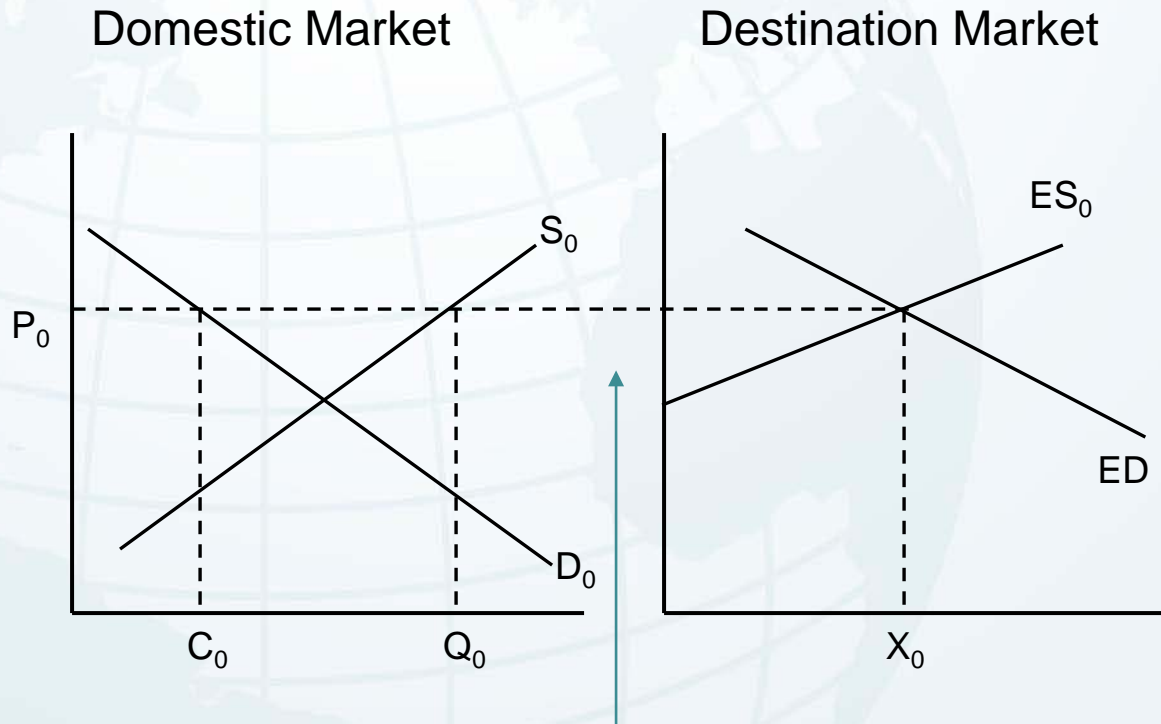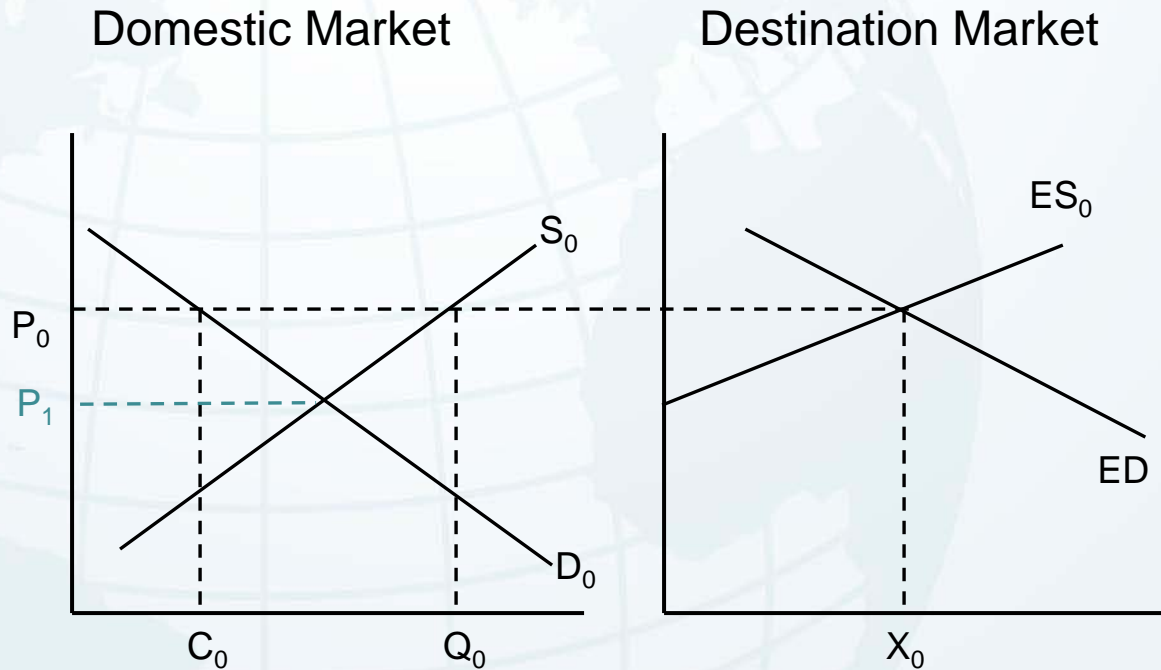
Possible Market Impacts of FMD Outbreak

Domestic Market

Destination Market

P_0

S_0

D_0

C_0

Q_0

ES_0

ED

X_0

Prior to Outbreak

- Difference between supply & demand in the domestic market, yields quantity available for export (ES_0)

- Foreign demand for meat shown by ED

Equilibrium price (P_0) determined by point where excess supply for export equals import demand by other countries

Possible Market Impacts of FMD Outbreak

Domestic Market

Destination Market

P_0

S_0

D_0

C_0 Q_0

ES_0

ED

X_0

Equilibrium price (P_0) determined by point where excess supply for export equals import demand by other countries

Prior to Outbreak

- Difference between supply & demand in the domestic market, yields quantity available for export (ES_0)

- Foreign demand for meat shown by ED

- UK is largely self-insufficient in the livestock sector – *import* implicitly in the domestic supply curve with important implications

Possible Market Impacts of FMD Outbreak

Domestic Market

Destination Market

FMD Outbreak
Possible Impacts

(i) Closure of export market

- Equilibrium price falls to P_1

Possible Market Impacts of FMD Outbreak
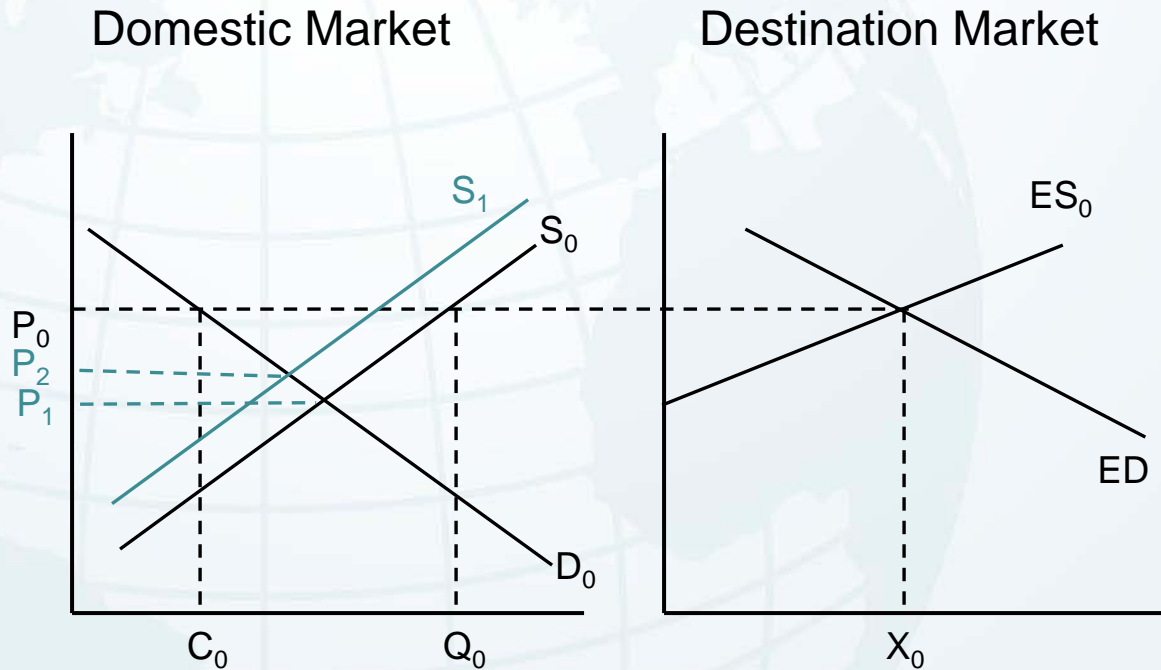
Domestic Market

Destination Market

FMD Outbreak
Possible Impacts

(i) Closure of export market

- Equilibrium price falls to P_1

(ii) Production reduces due to culling of animals

- Domestic supply curve shifts left (S1)

- Equilibrium price increases from P_1 to P_2

Possible Market Impacts of FMD Outbreak
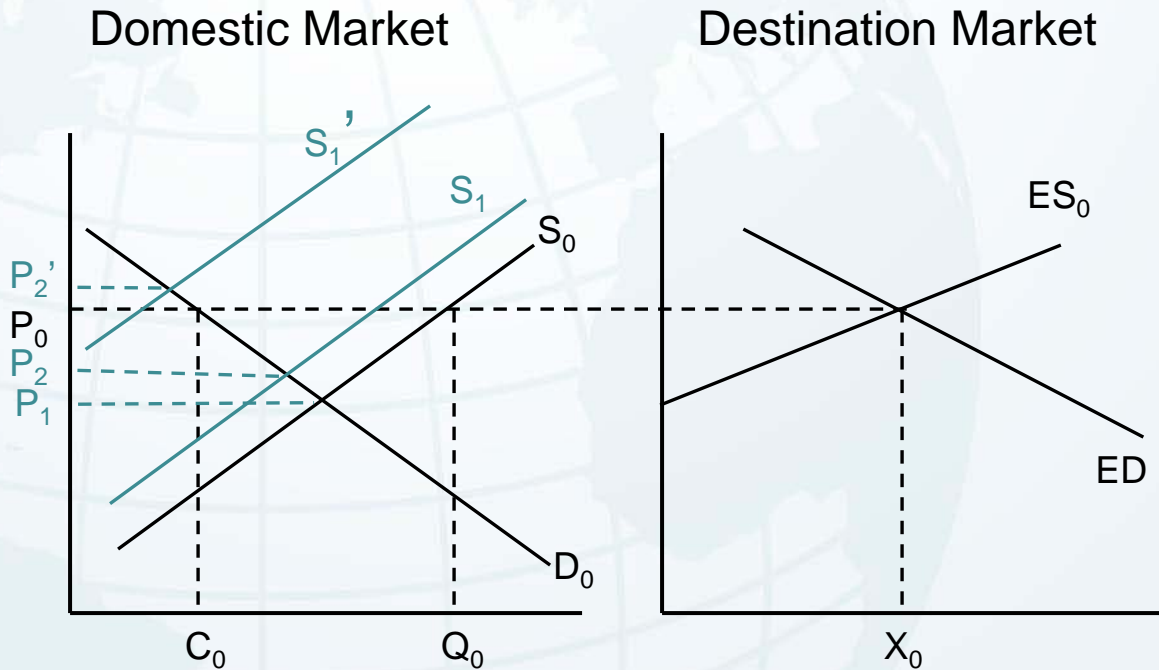
Domestic Market

Destination Market

FMD Outbreak
Possible Impacts

(i) Closure of export market

- Equilibrium price falls to P_1

(ii) Production reduces due to culling of animals

- Domestic supply curve shifts left ($S1$)
- Equilibrium price increases from P_1 to P_2

- P_2 not necessarily lower than P_0
- Remember the import part in the supply curve in the case of the UK

SCENARIOS AND MODEL

FMD Scenarios

Animal and Plant Health Agency simulated EXODIS epidemiological model under alternative FMD control strategies

- *Stamping-Out (SO)*
- *Vaccinate-to-Die (V-t-D)*
- *Vaccinate-to-Live (V-t-L)*

FMD Scenarios (Cont.)

Outputs from EXODIS model used as input data within FAPRI-UK partial equilibrium model

- Duration of outbreak
- Number of culled animals
- Number of vaccinated animals
- Stochastic outcomes at different percentiles (50th, 5th, 95th) used

Scenarios compared against a Baseline with no disease outbreak

EXODIS
50th (median), 5th, 95th percentile outcomes

FAPRI

UK

EU

Trade

RoW

Trade

$S\ (P, P_{other}) = D(P, P_{other})$
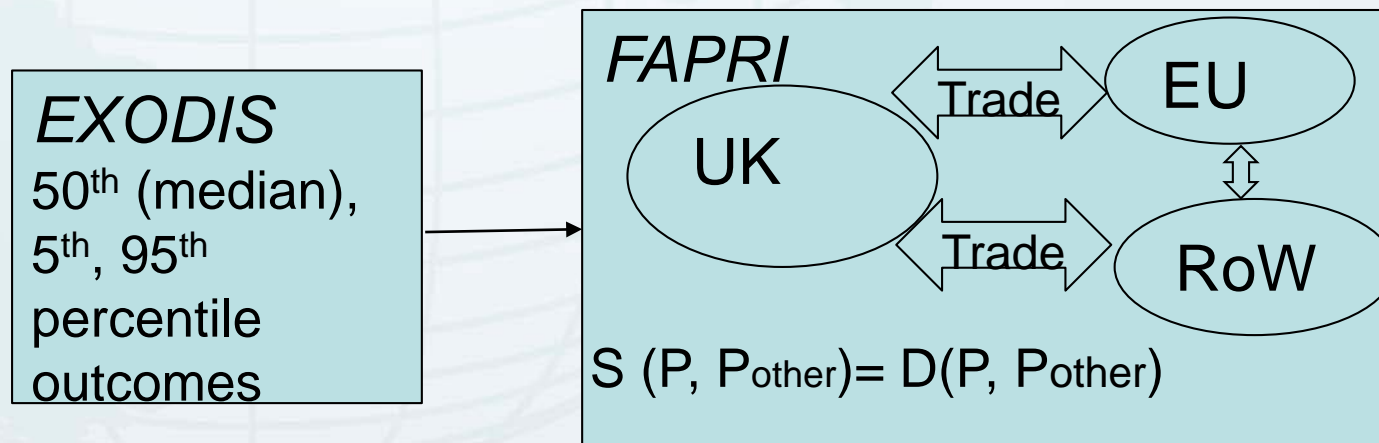
Poll question 2

- **Have you seen this type of study before?**

- **Answer:**
  - **Yes**
  - **No**

FMD Scenarios (Cont.)

Additional assumptions needed for economic modelling
- *How long is the export ban?*
  - *Disease duration plus 90 (SO and V-t-D)/180 (V-t-L) days*
- *What to do with the vaccinated livestock in V-to-L?*
  - *Slaughter immediately but receive discounted value*

EXODIS
50th (median),
5th, 95th
percentile
outcomes

FAPRI

UK

Trade

EU

Trade

RoW

S (P, Pother)= D(P, Pother)
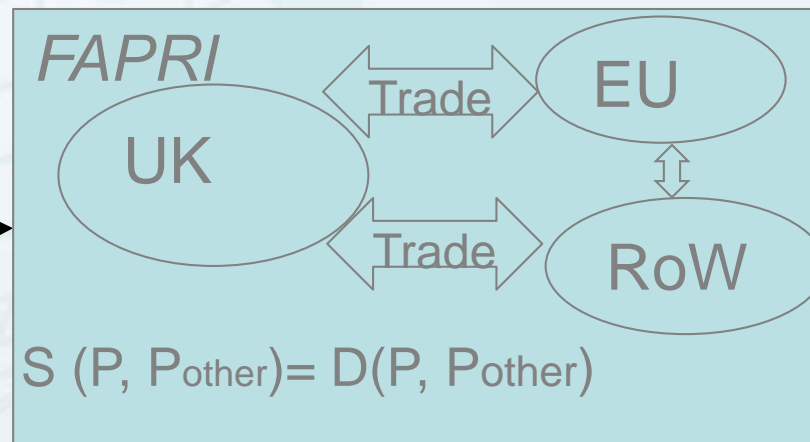
FMD Scenarios (Cont.)

(Results from EXODIS model)		Stamping-Out	Vaccinate-to-Die	Vaccinate-to-Live
Infected Premises	Median	230	120	179
	5 Percentile	134	75	115
	95 Percentile	360	181	264
Period to apply for	Median	182 (92+90)	139 (49+90)	243 (63+180)
Disease Free Status (days)	5 Percentile	151 (61+90)	125 (35+90)	229 (49+180)
(Disease period + Waiting period)	95 Percentile	237 (147+90)	165 (75+90)	281 (101+180)
Total Culled Animals	Median	342,558	1,020,682	280,375
	5 Percentile	191,310	636,701	171,690
	95 Percentile	593,892	1,444,701	441,683
Total Vaccinated Animals	Median	-	837,518	1,028,378
	5 Percentile	-	529,050	719,676
	95 Percentile	-	1,174,954	1,526,405

EXODIS
50th (median), 5th, 95th percentile outcomes

FAPRI

UK

EU

RoW

Trade

Trade

$S (P, P_{other}) = D(P, P_{other})$
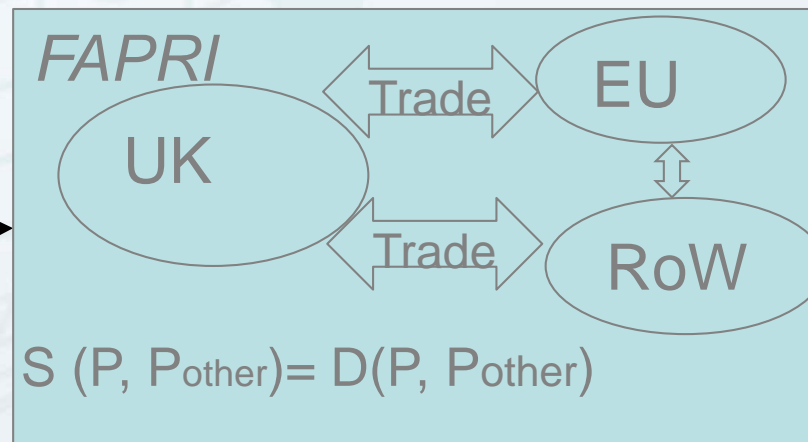
FMD Scenarios (Cont.)

Sensitivity analysis 1 - import response

- Main analysis (*Endogenous displacement*) : modelling of import to the UK based on economic parameters
- *No displacement*: no displacement of import by export re-diverted to the domestic market (no reduction in import)
- *Substantial displacement*: import reduced by 90% of export re-diverted to the domestic market

EXODIS
50th (median),
5th, 95th
percentile
outcomes

FAPRI

UK

Trade

EU

Trade

RoW

$S (P, P_{other}) = D(P, P_{other})$
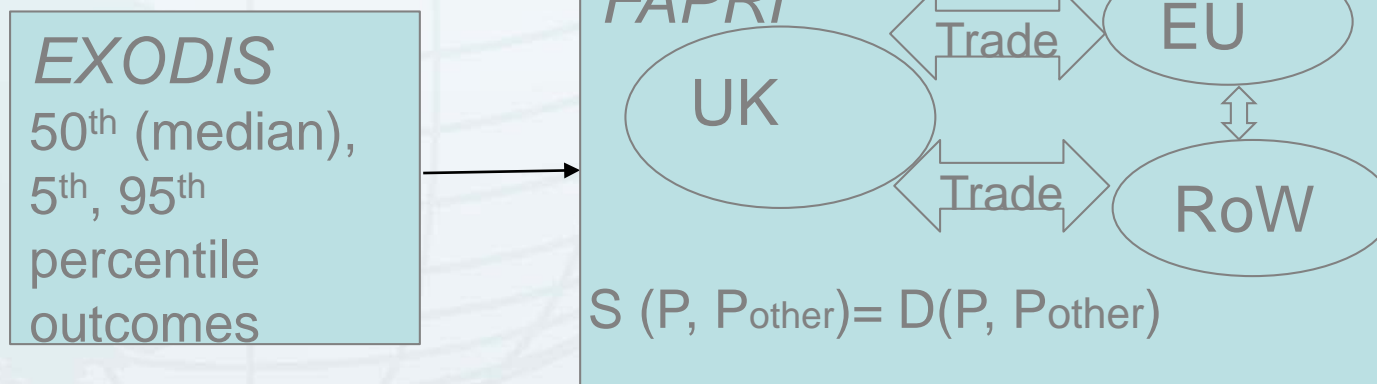
FMD Scenarios (Cont.)

Sensitivity analysis 2
- What is the maximum number of days of delay in culling in V-t-D without making it worse than SO?

EXODIS
50th (median),
5th, 95th
percentile
outcomes

FAPRI

UK

Trade → EU

Trade → RoW

S (P, P$_{other}$)= D(P, P$_{other}$)
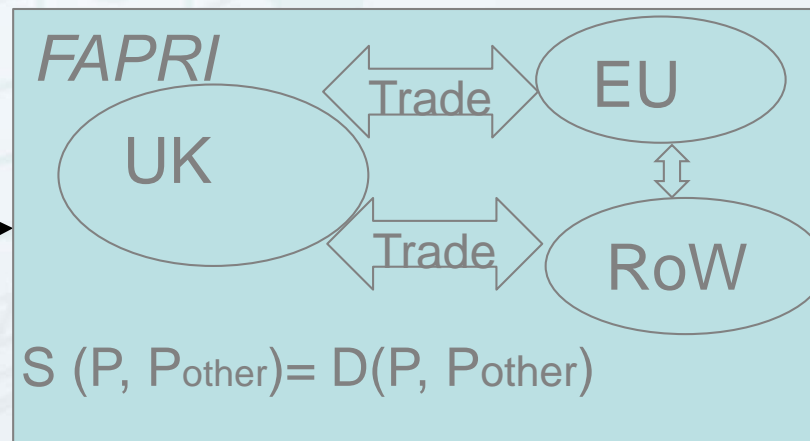
RESULTS

Results

Price Change- Beef	5th	50th	95th
SO Beef	-7.2%	-7.9%	-9.3%
V-t-D Beef	-5.5%	-5.8%	-7.0%
V-t-L Beef	-10.0%	-10.8%	-10.6%
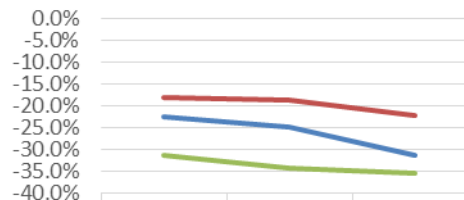
Price Change- Sheep	5th	50th	95th
SO Sheep	-22.5%	-24.7%	-31.4%
V-t-D Sheep	-18.1%	-18.6%	-22.1%
V-t-L Sheep	-31.3%	-34.2%	-35.5%

Price Change- Pig	5th	50th	95th
SO Pig	-15.5%	-17.3%	-22.2%
V-t-D Pig	-12.9%	-13.5%	-16.5%
V-t-L Pig	-22.0%	-24.5%	-25.5%
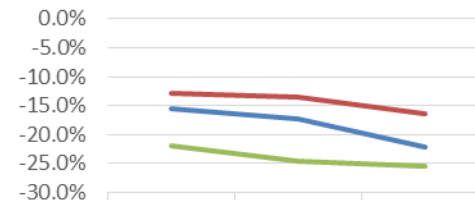
Prices fall following outbreak – impacts of export ban dominate fall in production, but the extent varies widely across sectors.

Results
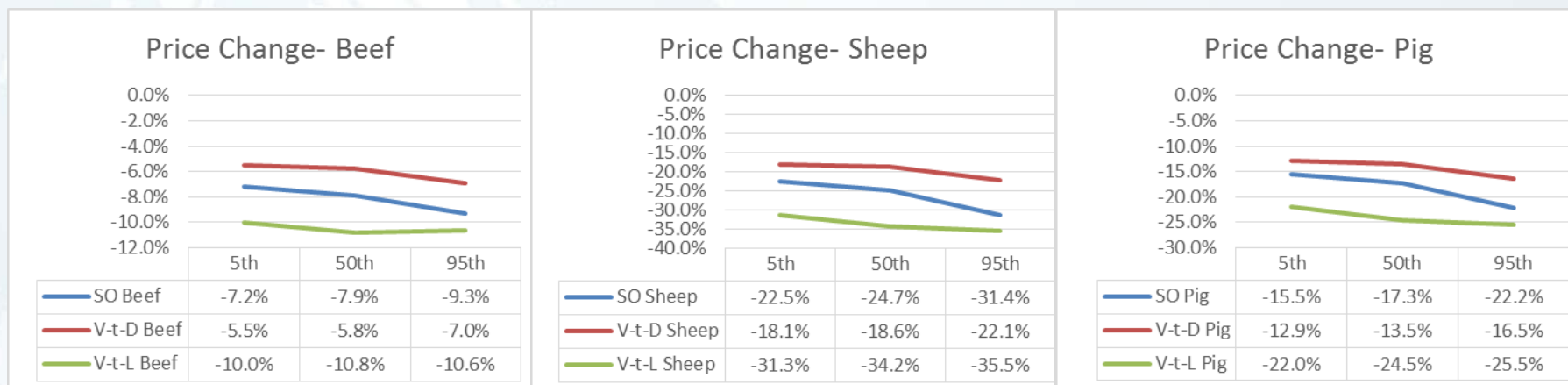
Price Change- Beef

	5th	50th	95th
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V-t-L Beef	-10.0%	-10.8%	-10.6%

Price Change- Sheep

	5th	50th	95th
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Prices fall following outbreak – impacts of export ban dominate fall in production, but the extent varies widely across sectors.

Severity of price drops increase with scale of the outbreaks.

Some segments of the line are horizontal/ upward sloping- production shock and length of export ban offsetting each other

Results
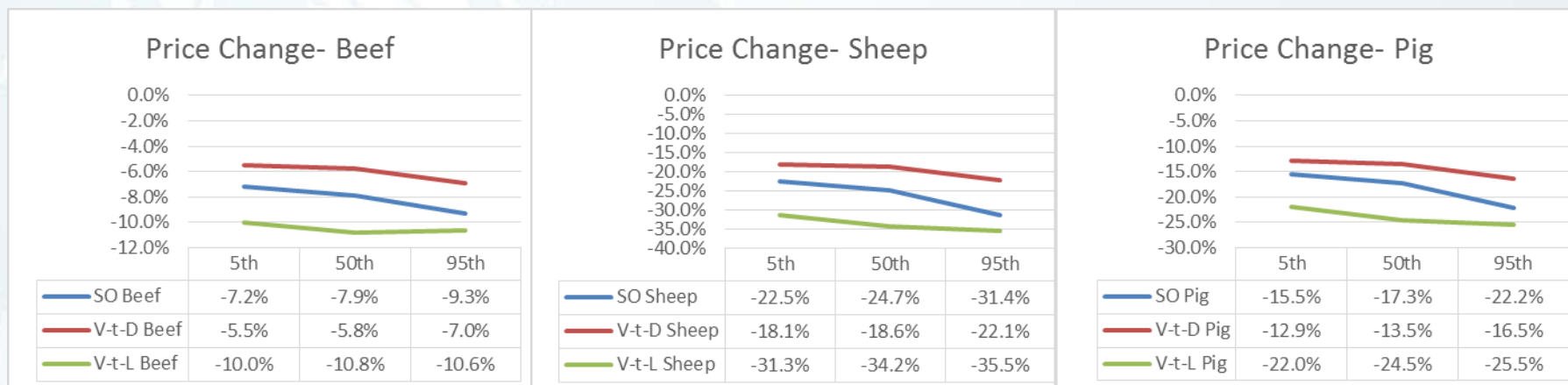
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Price Change- Sheep	5th	50th	95th
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Price Change- Pig	5th	50th	95th
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V-t-D Pig	-12.9%	-13.5%	-16.5%
V-t-L Pig	-22.0%	-24.5%	-25.5%

Prices fall following outbreak – impacts of export ban dominate fall in production, but the extent varies widely across sectors.

Severity of price drops increase with scale of the outbreaks.

Some segments of the line are horizontal/ upward sloping- production shock and length of export ban offsetting each other

How does this translate into output values?

Poll question 3

- **Do you think the ranking of impact on output value follow a similar pattern, i.e. the least preferable for Vaccinate to Live and the most preferable for Vaccinate to Die?**

- **Answer:**
  - **Yes**
  - **No**
  - **It depends**

Results

Output values also fall following outbreak, severity increase with scale of the outbreaks.

Example of beef sector
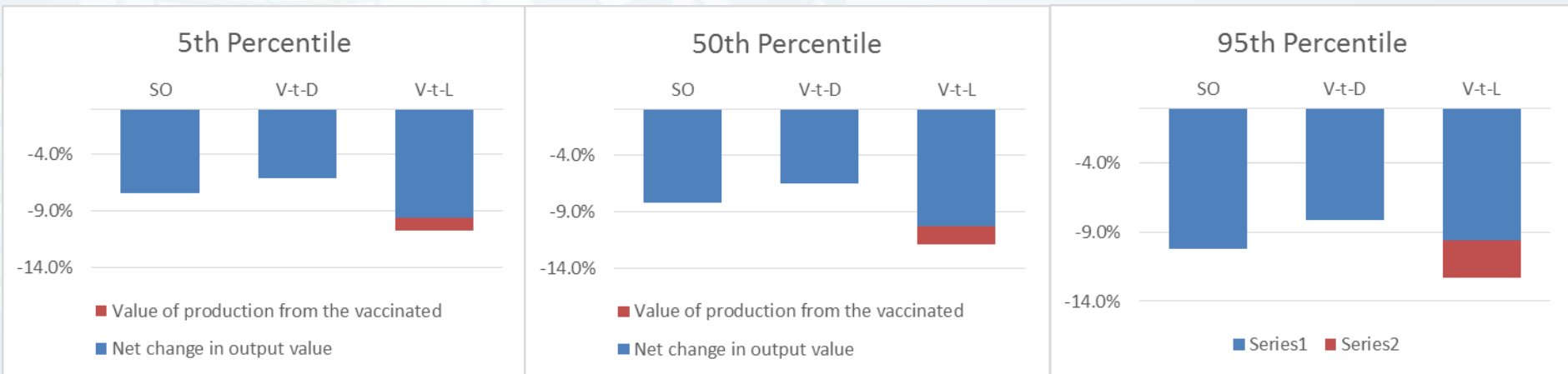
Ranking largely follows the price results. Vaccinate-to-Die is preferred most of the time. However, with large scale outbreak, Vaccinate-to-live no worse than Stamping out.

SENSITIVITY ANALYSIS- IMPORT DISPLACEMENT

SO Beef price — Substantial displacement / Endogenous displacement / No displacement; x-axis 5th, 50th, 95th; y-axis 0% to -18%.
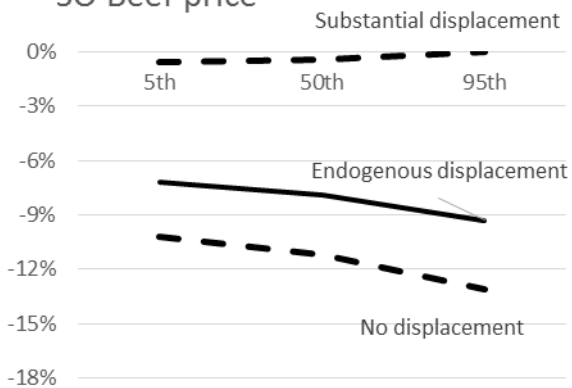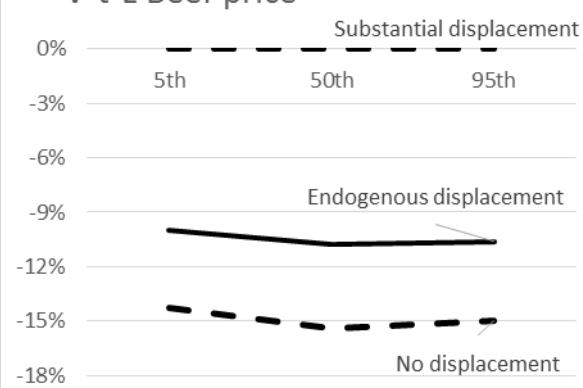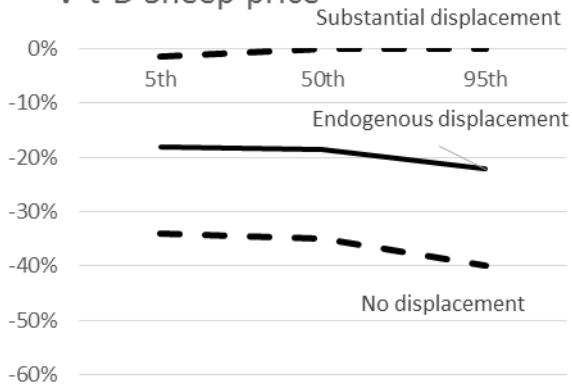
V-t-D Beef price — Substantial displacement / Endogenous displacement / No displacement; x-axis 5th, 50th, 95th; y-axis 0% to -18%.

V-t-L Beef price — Substantial displacement / Endogenous displacement / No displacement; x-axis 5th, 50th, 95th; y-axis 0% to -18%.

SO Sheep price — Substantial displacement / Endogenous displacement / No displacement; x-axis 5th, 50th, 95th; y-axis 0% to -60%.

V-t-D Sheep price — Substantial displacement / Endogenous displacement / No displacement; x-axis 5th, 50th, 95th; y-axis 0% to -60%.

V-t-L Sheep price — Substantial displacement / Endogenous displacement / No displacement; x-axis 5th, 50th, 95th; y-axis 0% to -60%.

SO Pig price — Substantial displacement / Endogenous displacement / No displacement; x-axis 5th, 50th, 95th; y-axis 0% to -36%.

V-t-D Pig price — Substantial displacement / Endogenous displacement / No displacement; x-axis 5th, 50th, 95th; y-axis 0% to -36%.

V-t-L Pig price — Substantial displacement / Endogenous displacement / No displacement; x-axis 5th, 50th, 95th; y-axis 0% to -36%.
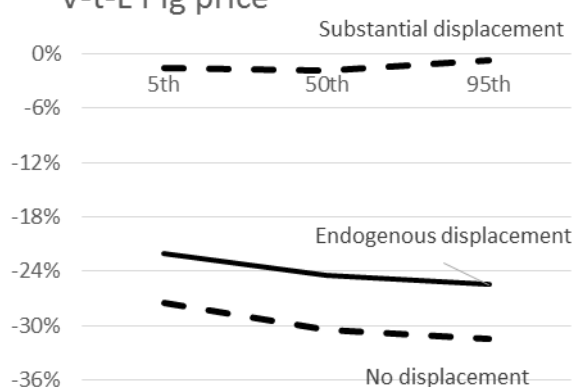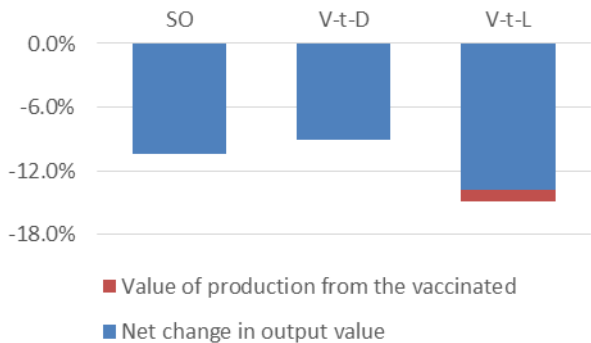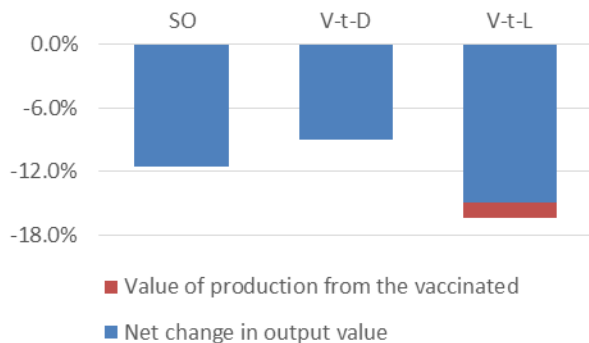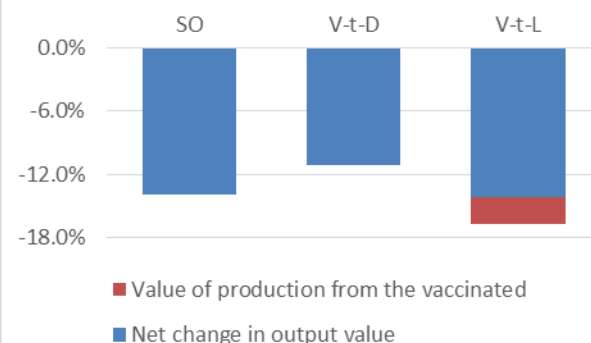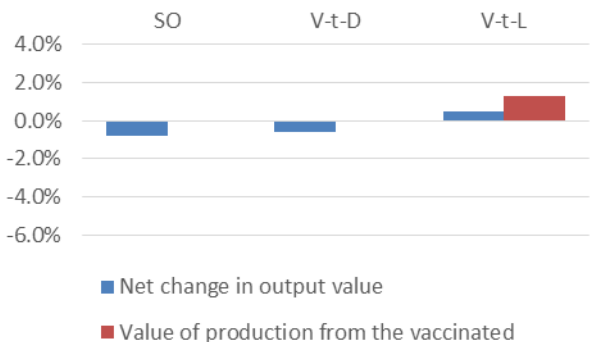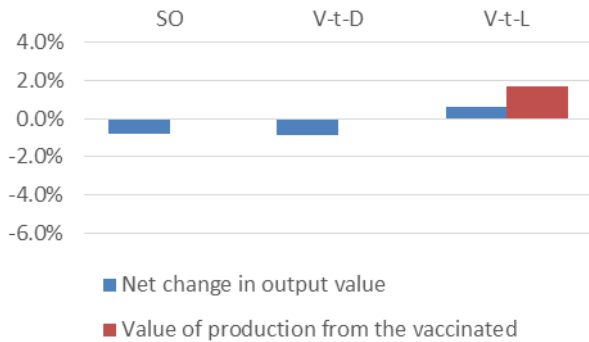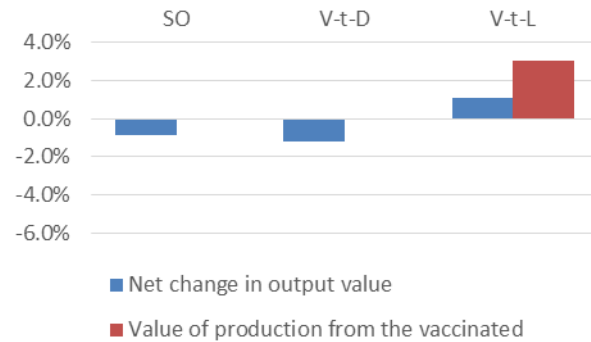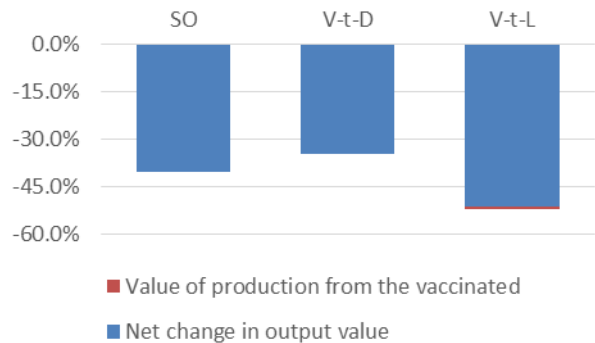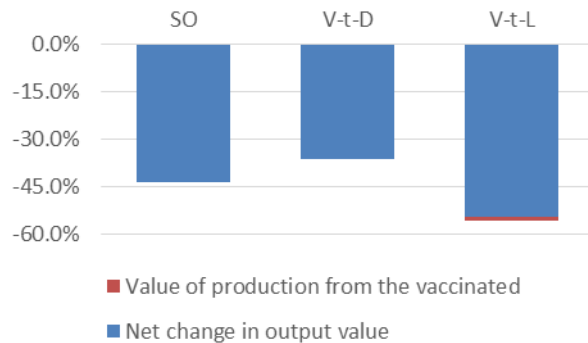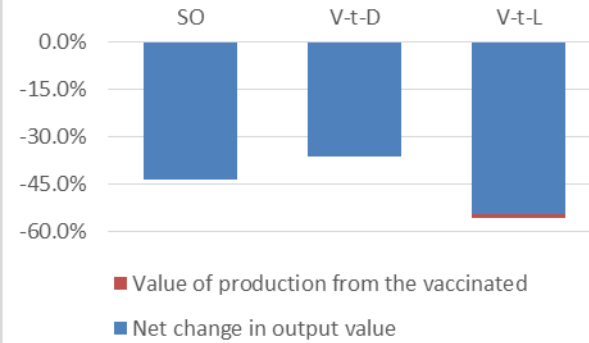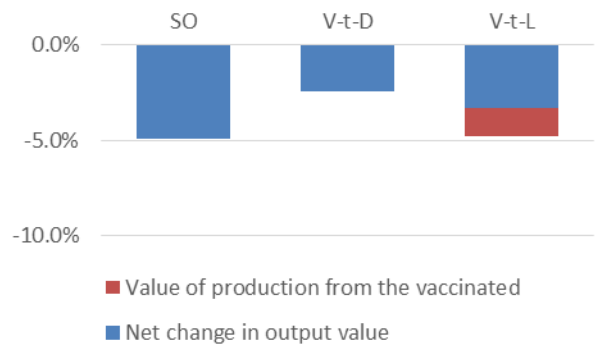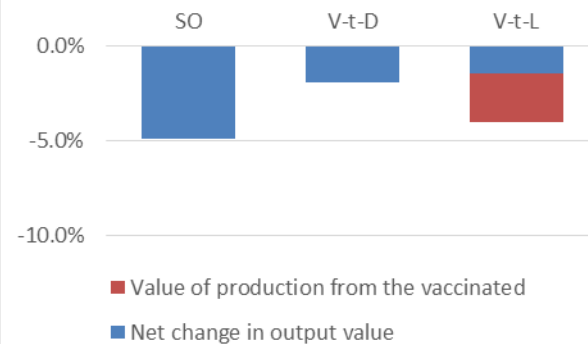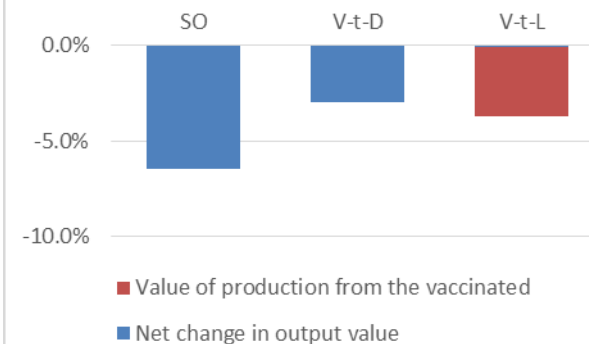
Beef Output Value

Sheep Output Value

Pig Output Value
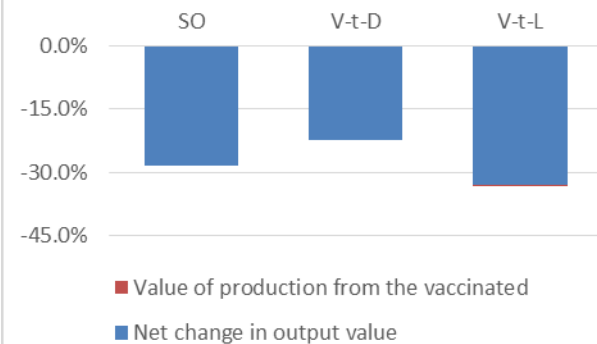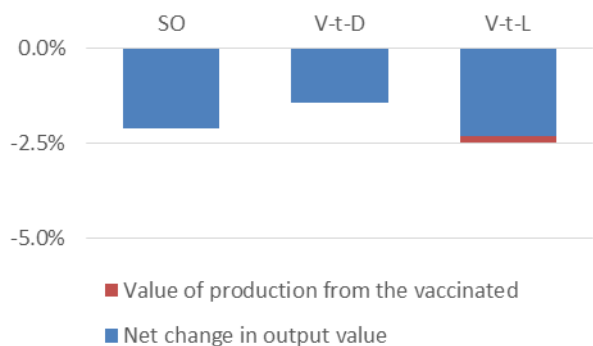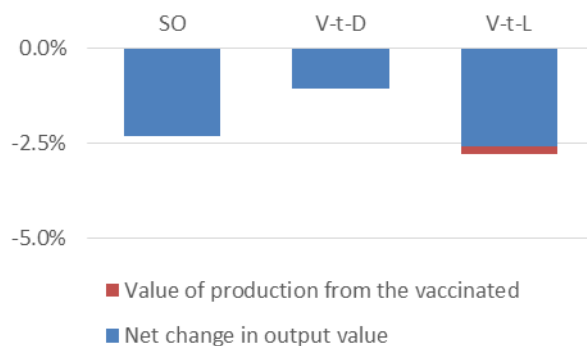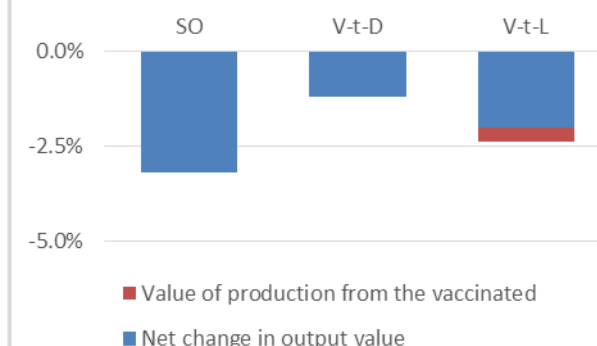
Delays in Vaccinate-to-Die

Possible delays to the waiting period under Vaccination-to-Die

- Previous scenarios – assumed under Vaccination-to-Die that livestock can be culled in a timely manner
  - ➤ i.e. no extra time needed to complete culling of vaccinated animals
- But logistics may result in delays
  - ➤ E.g. under the median scenario, total number of culled animals is 3 times higher under Vaccinate-to-Die compared to Stamping-Out
- What is the *break-even* delay?
  - ➤ Delay under Vaccinate-to-Die that results in all the sectors obtaining output values at least as much as the Stamping-Out case
  - ➤ 33 days (based on a median outbreak)

CONCLUSIONS

Conclusions

- Overall price effect negative
  - Closure of export markets outweighs fall in production
  - Regardless of control strategy
- Market impacts of Vaccination
  - _Vaccinate-to-Die_ generally has the least impact. Logistical delays under _Vaccinate-to-Die_ may diminish these benefits
  - Market impact usually the most serious in _Vaccinate-to-Live_, but can rival _Stamping Out_ in large scale outbreaks
  - Other budgetary costs need to be considered as well
- Sensitivity analysis highlights uncertainties around the numerical results.

  - For a country with both imports and exports, import adjustment plays an important role- ranking of strategies can change with different rates of adjustment.

- **Further readings:**

➢ Paarlberg, P.L., Seitzinger, A.H., Lee, J.G. and Mathews Jr, K.H., 2008. Economic impacts of foreign animal disease. ERR– 57. US Dep. of Agric. Econ. Res. Serv.

➢ Hagerman, A.D., B. A. McCarl, T.E. Carpenter, M.P. Ward, and J. O'Brien. "Emergency Vaccination to Control Foot-and-Mouth Disease: Implications of its Inclusion as a US Policy Option." Applied Economic Perspectives and Policy 34, no. 1 (2012): 119-146.

➢ Buetre, B., S. Wicks, H. Kruger, N. Millist, A. Yainshet, G. Garner, A. Duncan, A. Abdalla, C. Trestrail, and M. Hatt. Potential Socio-Economic Impacts of an Outbreak of Foot-and-Mouth Disease in Australia. Canberra, Australia: Australian Bureau of Agricultural and Resource Economics and Sciences, 2013.

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