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How economics shapes responses to disease presence and risk

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Introduction

- I have covered the **economic impact assessment** of **animal health problems**
- This was used as a **baseline** to assess changes that are believed to create positive change
- And I have discussed how to **assess change** from an economic perspective
- I want to complete this set of presentations by exploring how our responses to disease presence or risk are shaped by the **socio-economic context**

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Introduction

- This context determines the **prices** of **animals** and the **livestock products** they generate
- It also shapes **prices** of **technologies** available for **surveillance**, **prevention** and **control**
- And, the context is sets by the **wider societal changes** which are important with regards animal health

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The changing role of animals in society

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Our grazing species

Historical perspective

- The first species to be domesticated was the dog followed by goats, sheep, cattle, pigs, poultry
- Very few species have been domesticated as the process requires specific characteristics
- And the process of domestication for grazing animals is likely to have been different from scavenging species such as the dog, pig, poultry
  - **Grazing animals** were probably **hunted then managed**
  - **Scavenging animals** probably **followed humans** and then were **incorporated into societies**

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Our scavenging species

Historical perspective

- These domesticated species were useful in many ways:
  - The dogs provided **protection** and **assistance in hunting**
  - The **grazing** animals **collected energy from grasses** and **browse** not accessible to humans to generate **milk, wool, fat, meat, skins, bone**
  - The **scavengers** also searched and ate food not accessible to humans to generate **fat, meat and eggs**
  - **Equines, cattle, camels** provided **power** to **cultivate** land and for **transport**
  - **Horses** were critical for **warfare**

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Woman resting with her horse Mongolia

Animals for power and transport

Ploughing with buffalo Vietnam

Horses in sheep production Australia

More recent times

- With the discovery of **coal and oil** the role of animals began to **change**
- There was **less need** for **animals** to
  - **generate power**
  - **harvest energy** from the **wider environment**
- The **change accelerated** around a hundred years ago with the widespread use of the **combustion engine**
- It has **accelerated again** around fifty years ago with the **intensification of cropping systems**

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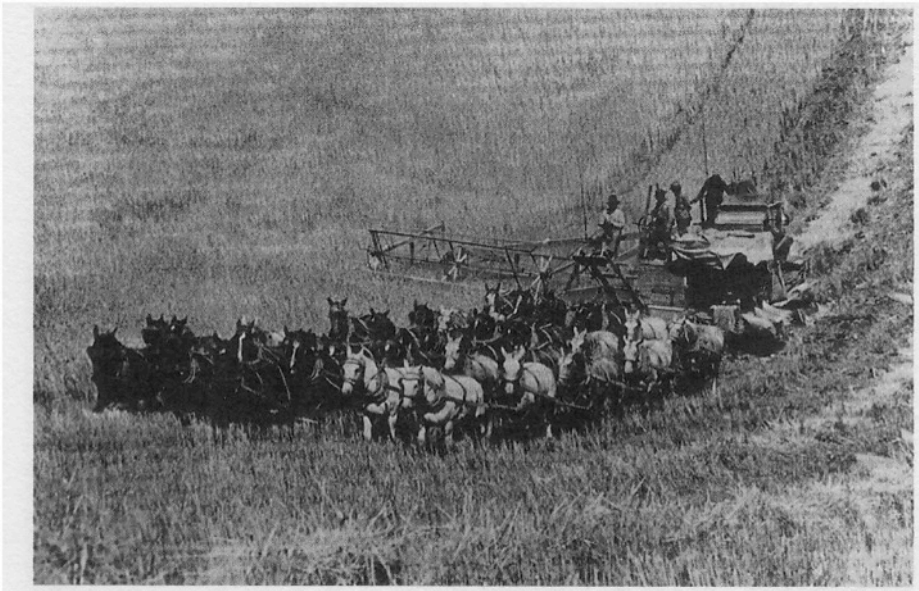
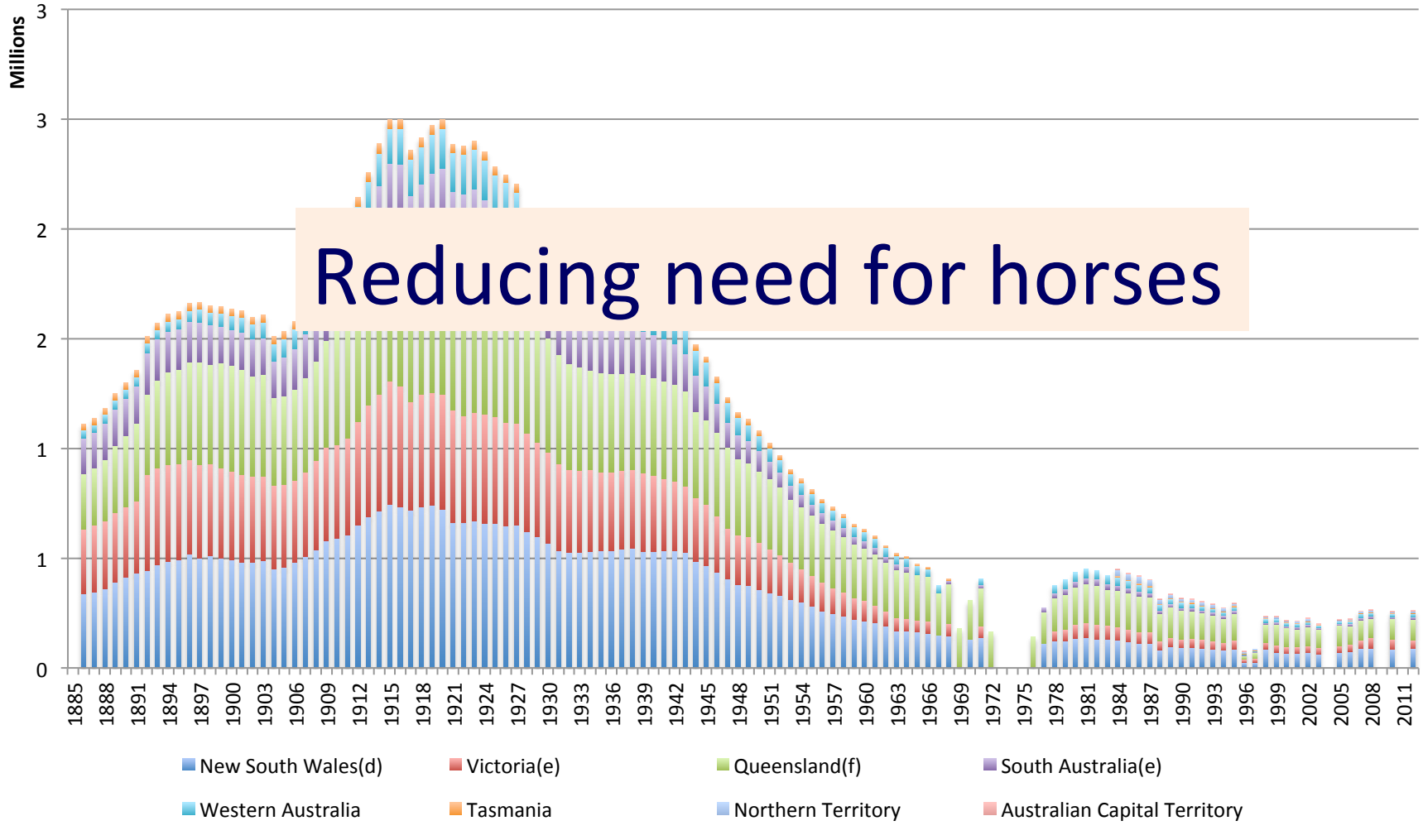


Major use for cultivation and harvesting

38 Harrowing with a team of oxen at the Warren, Aldbourne, Wiltshire, in 1911. The oxen wearing collars in place of the yokes in Plate 36. The Browns, of Aldbourne, who owned this team,

drawn ploughs.

Australian horse population 1885 to 2011 (Australian Bureau of Statistics, 2013)



In the last two decades

- Livestock

- There has been a **separation** between **people** and **livestock** through urbanisation and production system change
- Livestock are **handled** by very **few people**
- Yet **livestock products** are **consumed** by **everyone**
- Livestock are:
  - Kept in **intensive systems**
  - Fed **grain based concentrated diets** brought to them
  - Kept in **high population densities**

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In the last two decades

- Livestock

- There has been a **separation** between **people** and **livestock** through urbanisation and production system change

Livestock have a **low individual value** and this value has reduced dramatically over the last 50 years

- Kept in **intensive systems**
- Fed **grain based concentrated diets** brought to them
- Kept in **high population densities**

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Duck breeding flock
- Egypt

Chicken broiler flock
- Tanzania

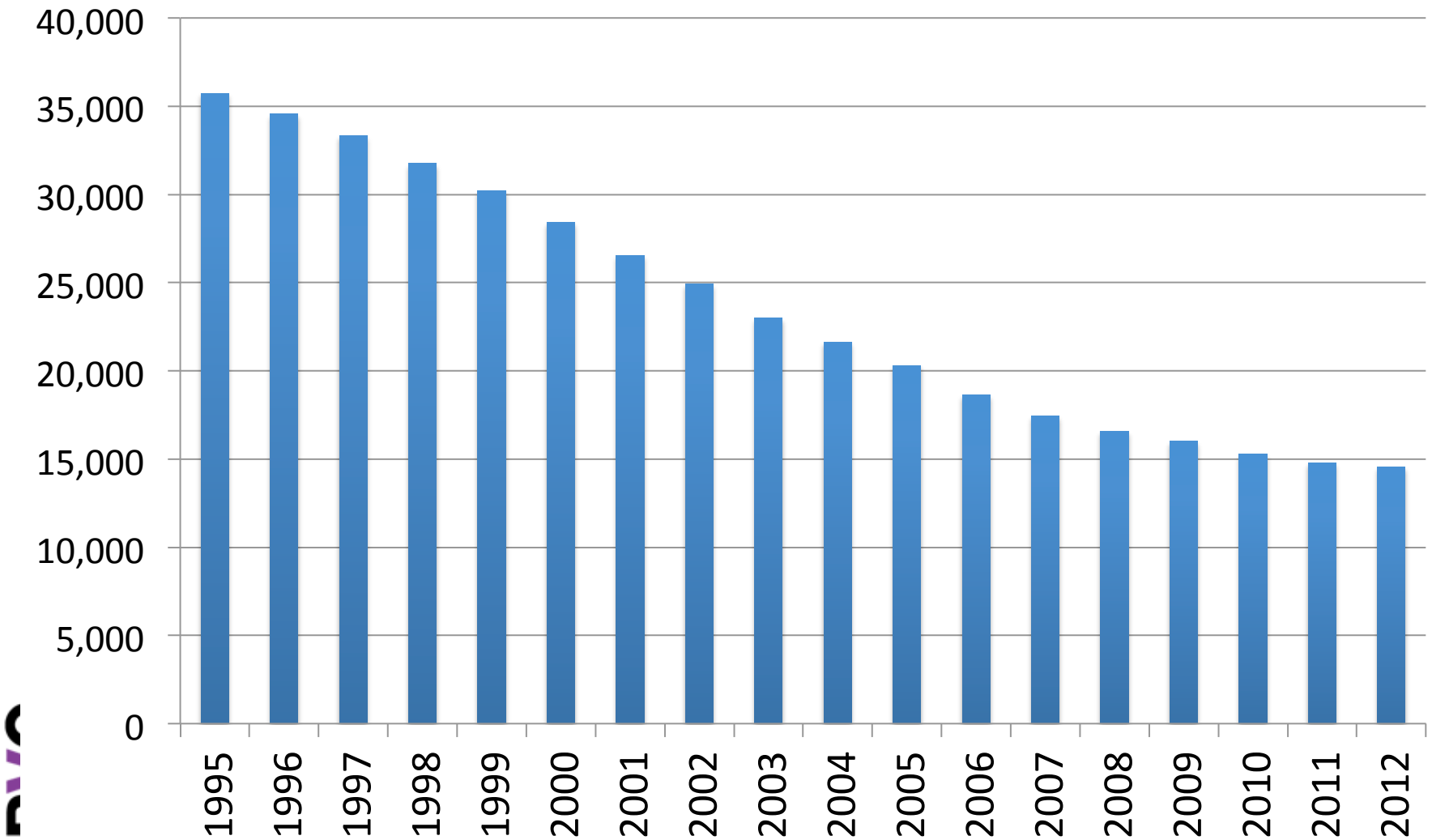
Beef cattle
– Northern Ireland

Dairy system –
Nairobi, Kenya

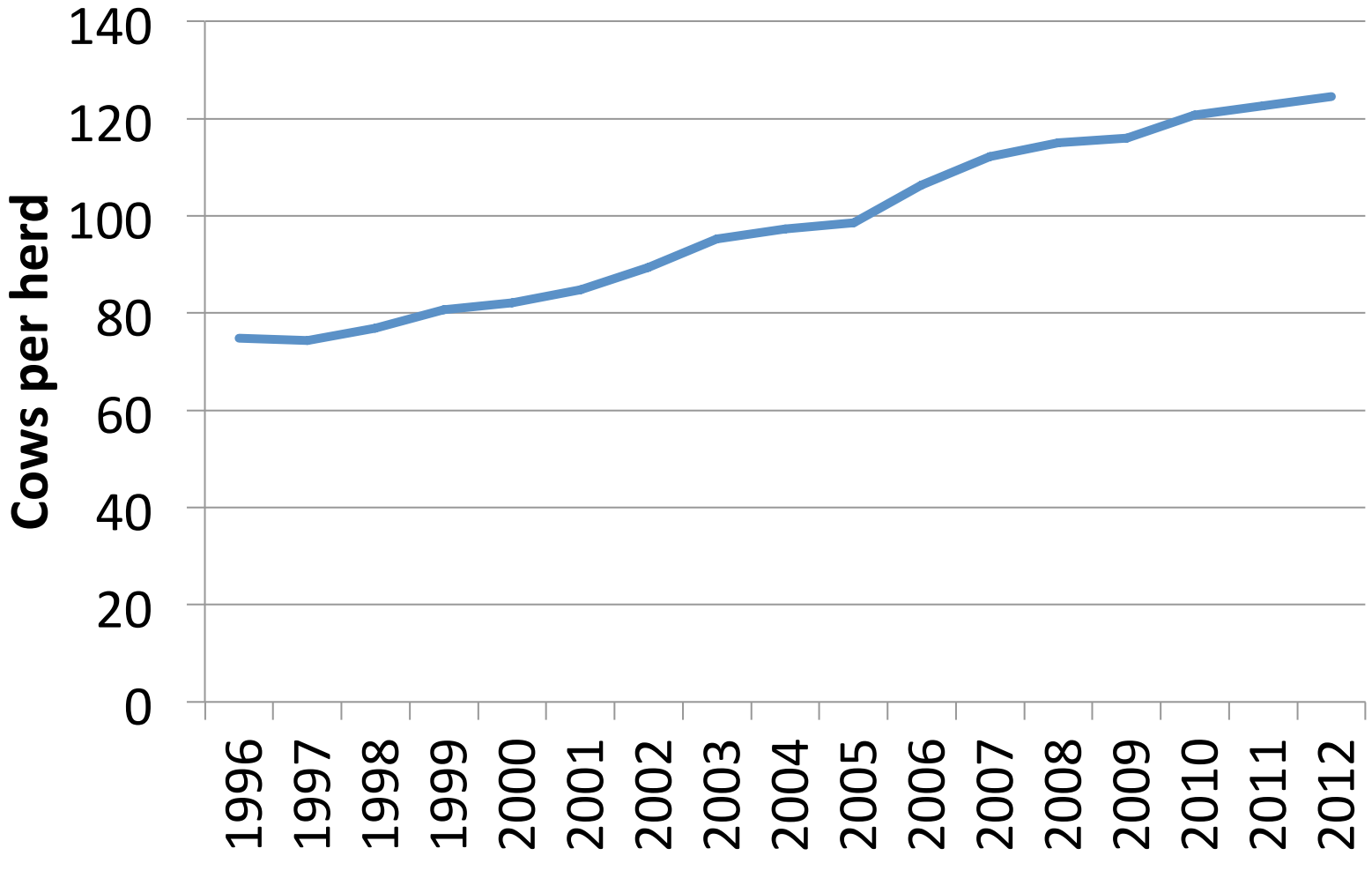
Sheep
– NSW, Australia

Outdoor pigs
– East Anglia, UK

Dairy farmers UK – 1995 to 2013



Average herd size 1996-2012



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Intensive poultry unit - Honduras

Intensive pig unit - Albania

Foie Gras geese - France

Intensive dairy unit – Herts, UK

In the last two decades

- pets and sporting animals

- Pets are cared for like friends and family
- Sporting animals are part of the entertainment economy
- Others animals, such as horses and zoo animals, are involved in tourism

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In the last two decades

- pets and sporting animals

- Pets are cared for like friends and family
- Sporting animals are part of the entertainment

Pets, leisure and sporting animals have a **high individual value**

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Individual care and attention


Horse Drawn Cars
PRICE LIST
Temple Bar
The Jail
Jameson Whiskey Factory
St.Stephen's Green
Jervis Shopping Centre
St.Patrick's Cathedral
O Connell Street
Also Tours
half hour
1 hour

Supplement in the UK's Independent newspaper 30th September 2015

Summary of the animal role changes

- These **changes** in the **role of animals** have been dramatic in the last two decades

Leading to **changes in resource use** to look after animals

Pets and sporting animals have **individual** attention

- Increasingly **sophisticated healthcare**
- **Specialised diets**
- **Clothes, toys, treats**

While **livestock** are increasingly confined, raised, slaughtered and processed in **large groups**

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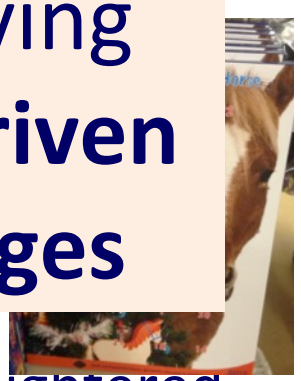
Summary of the animal role changes

- These **changes** in the **role of animals** have been dramatic in the last two decades

The role of animals is constantly evolving

Some of these changes are demand driven

Others relate to supply process changes



- While **livestock** are increasingly confined, raised, slaughtered and processed in **large groups**

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How the health of our animals has changed and how the animal health systems have responded

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The beginnings of the profession
- the importance of the horse

- The veterinary profession emerged with people who specialised in maintaining the health of horses
  - This was demanded from rulers who needed armies for invasion or protection
  - But it is also reflection of the relative value of animals for example in 1867 in Australia a heavy horse was worth ten times a breeding cow
- As we have seen the importance of the horse decreased over time with the widespread use of the combustion engine

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The initiation of veterinary systems
- food, food systems and disease

- The changes in human population in OECD countries and the migration of people to urban centres shifted the **demand for food and the shape of food systems**
- There were modifications of production and marketing systems and the **emergence of disease threats** – rinderpest, FMD, CBPP plus a range of zoonotic issues
- This creates a **societal demand** for **control measures** and **government investments in state services** – jobs and work for vets!

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And more recently

- ongoing problems with emerging disease

- The increases in human populations and shifts of location are ongoing – new diseases are still emerging
- This is not just in Africa and Asia, let's not forget that many of the major problems have come from Europe and North America e.g. BSE, PED
- So there are demands for veterinarians in understanding disease in populations – **epidemiology and in public health**
- And because epidemiology relates to how people behave it calls for an understanding of **economics and social science** – subjects that study why people do what they do

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More recently

- rising importance of pets

- The urbanised affluent people are separated from livestock, yet are increasingly attached to pets
- They have money and are willing to use it to improve the health of their animals
- Therefore there has been an **increase in demand for pet care** and vets have responded to these changes
- Most vet time is spent on these animals

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More recently

- changing business and policy environment

- The pet healthcare and the associated nutrition and accessory sales have attracted the interests of the **finance world**
- Many places are seeing investors buy veterinary practices and **pet businesses** developing into **corporate** entities
- And there are vets who have worked together to generate a **franchise** system
- The size of these new **businesses is large** compared to previous practice models, the role of the vet has changed

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On livestock health

- Animals kept for the production of meat, milk, eggs, wool – livestock are managed in groups
- Their healthcare is dependent on the skills and knowledge of farmers, vets and scientists
- There is great dependence on antimicrobials and immunological agents
- Individual animal attention is rare and the overall demand for specialised veterinarians is small

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The veterinarian and their changing roles

- Vets are increasingly part of large business activities that serve the pet sector
- There is also demand for veterinary skills at a societal level or in a large population management role
- And there is demand for veterinary public health work
- This reflects the changing wealth, demands and preferences of people in society

People's use of animals has changed and so has their use of vets

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How do we value resources?

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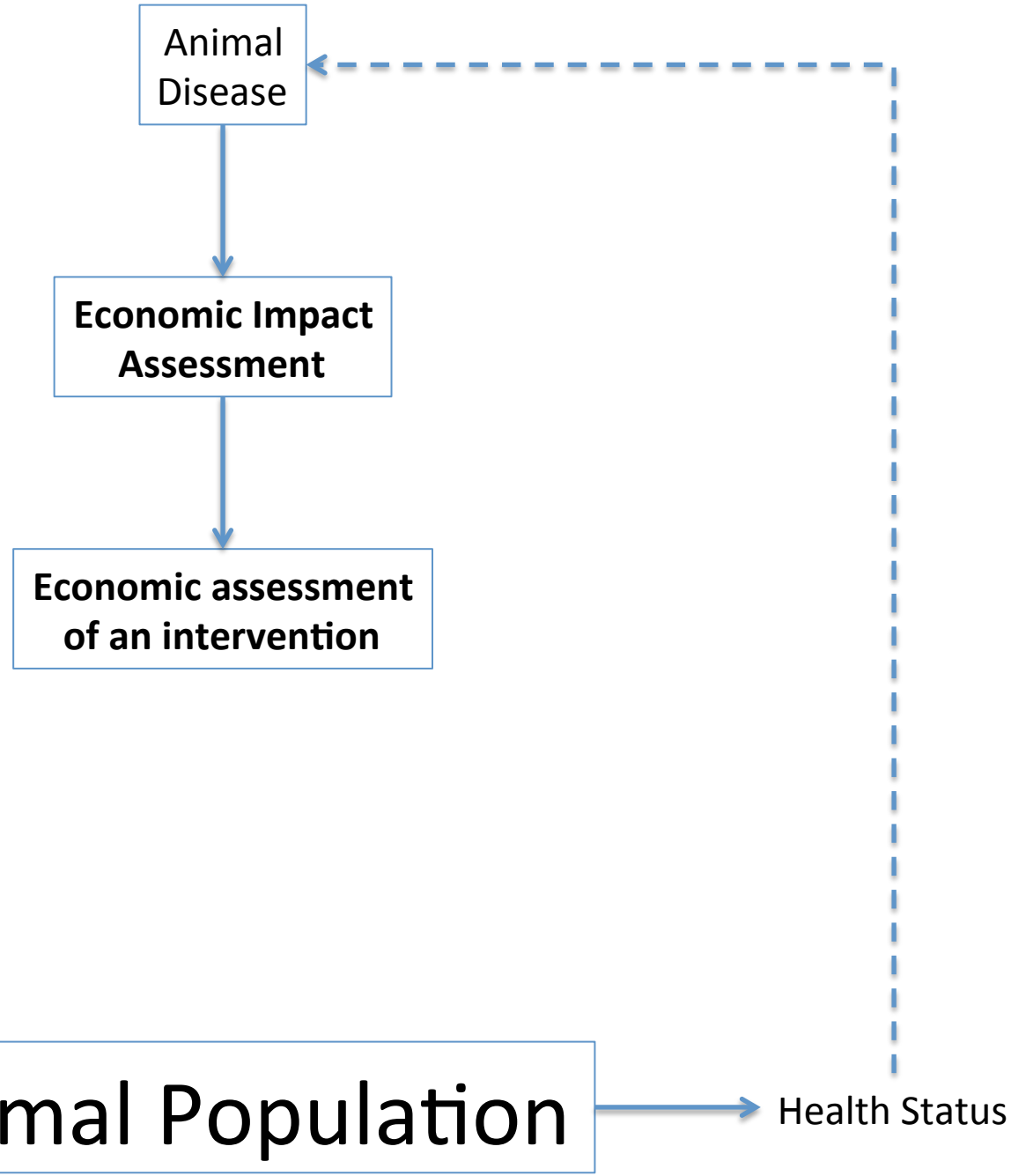
Data on:
- Scale – populations, farms
- Disease
- Parameters – fertility, mortality, sales
- Prices - markets

Estimates:
- **Prices – for good and services with no markets**



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Market price data – UK sources

- UK – livestock and livestock product prices
  - Farming press
    - http://www.farminguk.com/defrastats
  - Quality Meat Scotland
    - http://www.qmscotland.co.uk/market
  - DEFRA – have an excellent webpage
    - https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs/about/statistics
- UK - Meat prices
  - http://www.meat-prices.co.uk

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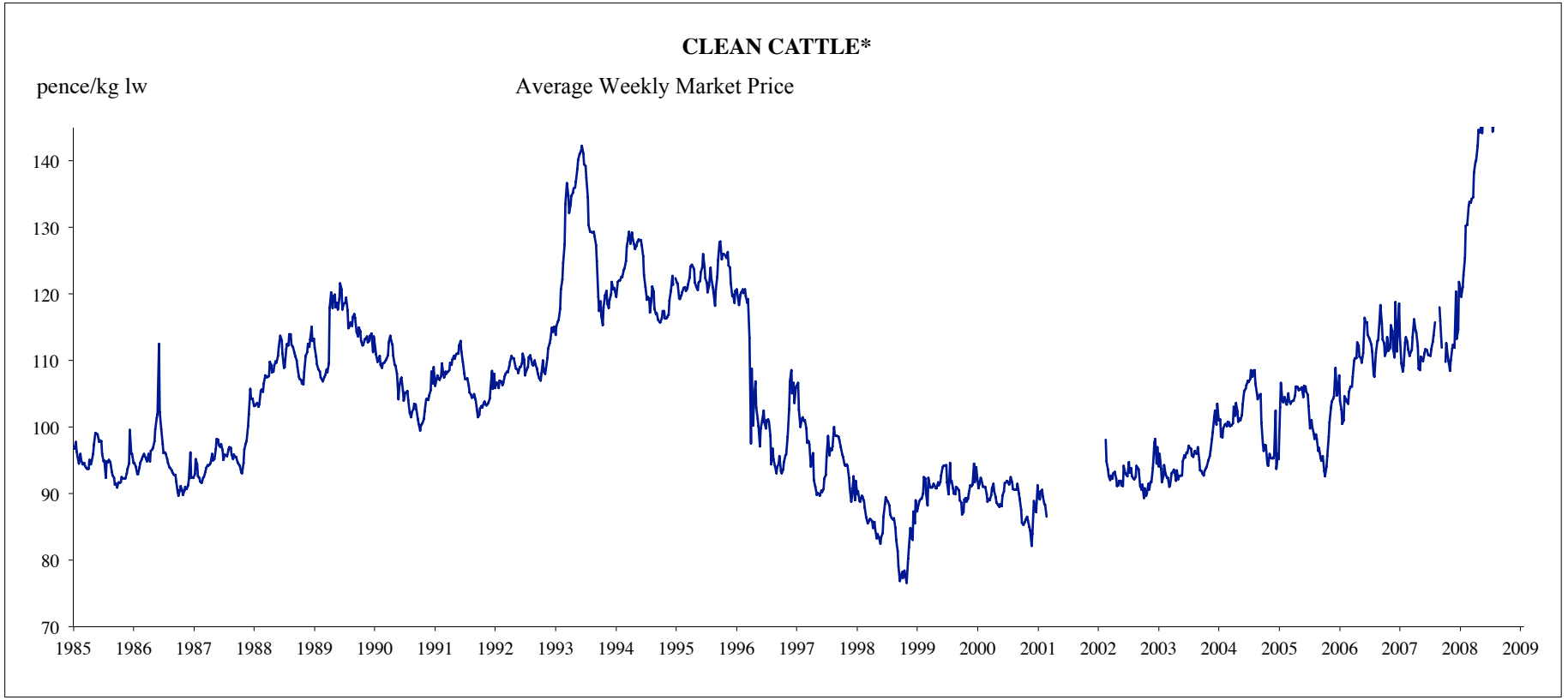
DEFRA Data


CLEAN CATTLE*
pence/kg lw
Average Weekly Market Price
140
130
120
110
100
90
80
70
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
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2004
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2006
2007
2008
2009

Market price data – USA and world sources

- USDA – Economic Research Services
  - http://www.ers.usda.gov/data-products/food-price-outlook.aspx
- FAO – world food price index
  - http://www.fao.org/worldfoodsituation/foodpricesindex/en/
- World Bank – commodity prices
  - http://www.worldbank.org/en/research/commodity-markets

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What influences prices?

- Consumer demand
  - Quantity
  - Quality
    - Taste
    - Presentation
    - Food safety
    - Welfare and production system standards

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What influences prices?

- Production supply
  - Cost of inputs
  - Breeds
  - Technology
    - Disease control
  - Transport
  - Processing and retailing

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What influences prices?

- Government policy
  - Subsidies
    - Inputs
    - Outputs
    - Technology and information
      - Veterinary research, education & services
  - Taxes
  - Facilitation of transactions in the market
    - Internet access
    - Market infrastructure

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What influences prices?

- Media
  - Food scares
    - Salmonella 80s
    - BSE 90s
    - HPAI 00s
  - Superchefs
- Marketing
  - Brand image

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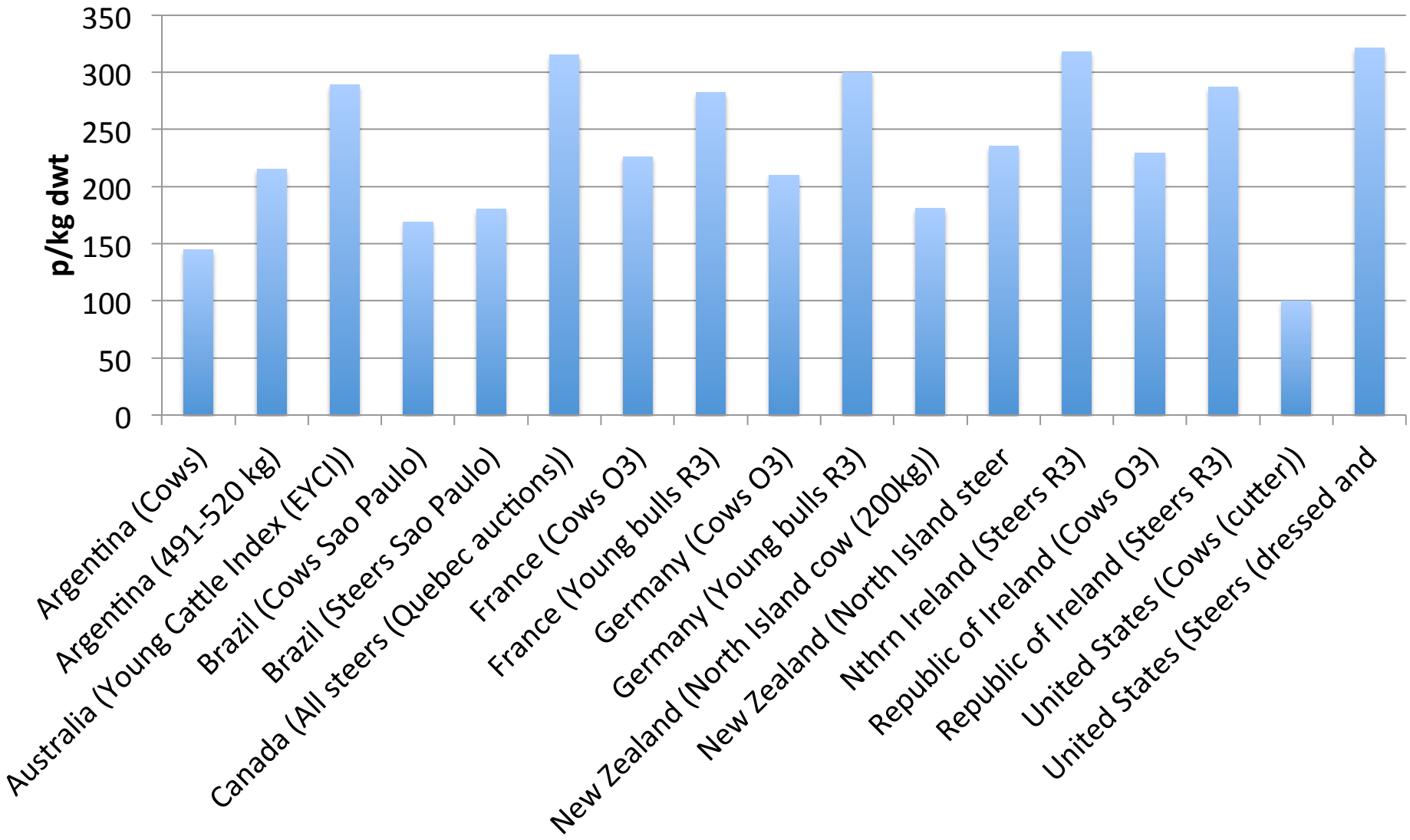
Cattle prices (p/kg DWT) – end of January early February 2016



Source: Quality Meat Scotland http://www.qmscotland.co.uk/market/prices/international

Things to think about with prices -

- Difference between liveweight and deadweight prices
- Influence of quality
- Meat is not a standard product
  - Different cuts
  - Different ages
  - Different preparations
- Value added through presentation, marketing and processing
  - Food safety
  - Method of production

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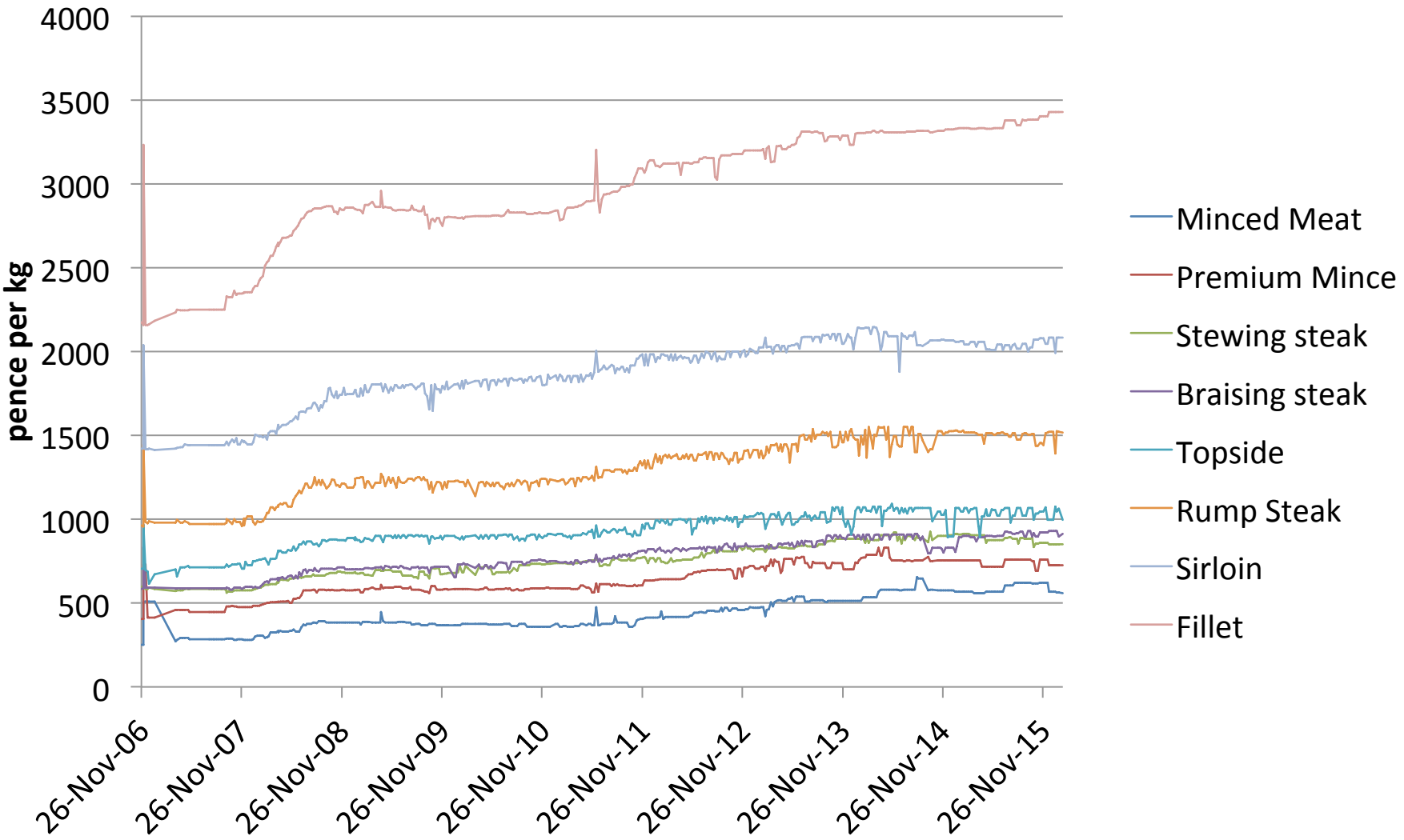
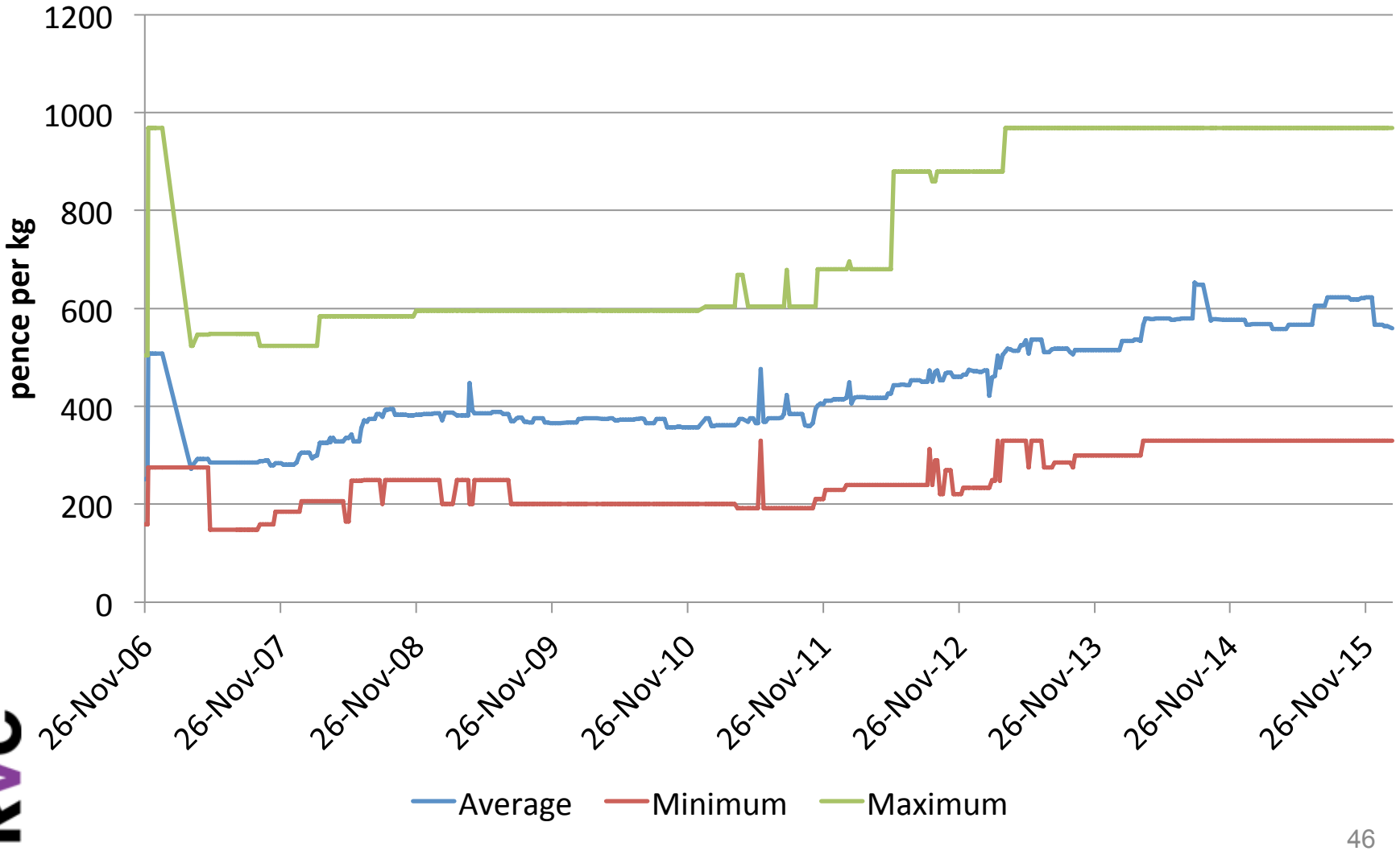
Prices of different cuts of meat (beef) – England 2006 to 2016



Average, minimum and maximum mince meat prices in England – 2006 to 2016



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Why are prices important for animal health?

- Prices give signals on what types of livestock and livestock products people prefer
  - Milk quality – cattle
  - Backfat thickness – pigs
  - Lamb versus mutton – sheep
- Prices give signals on what types of production system people prefer
  - Organic versus conventional farming
  - Housing systems
  - Grazing systems

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Absolute versus relative prices

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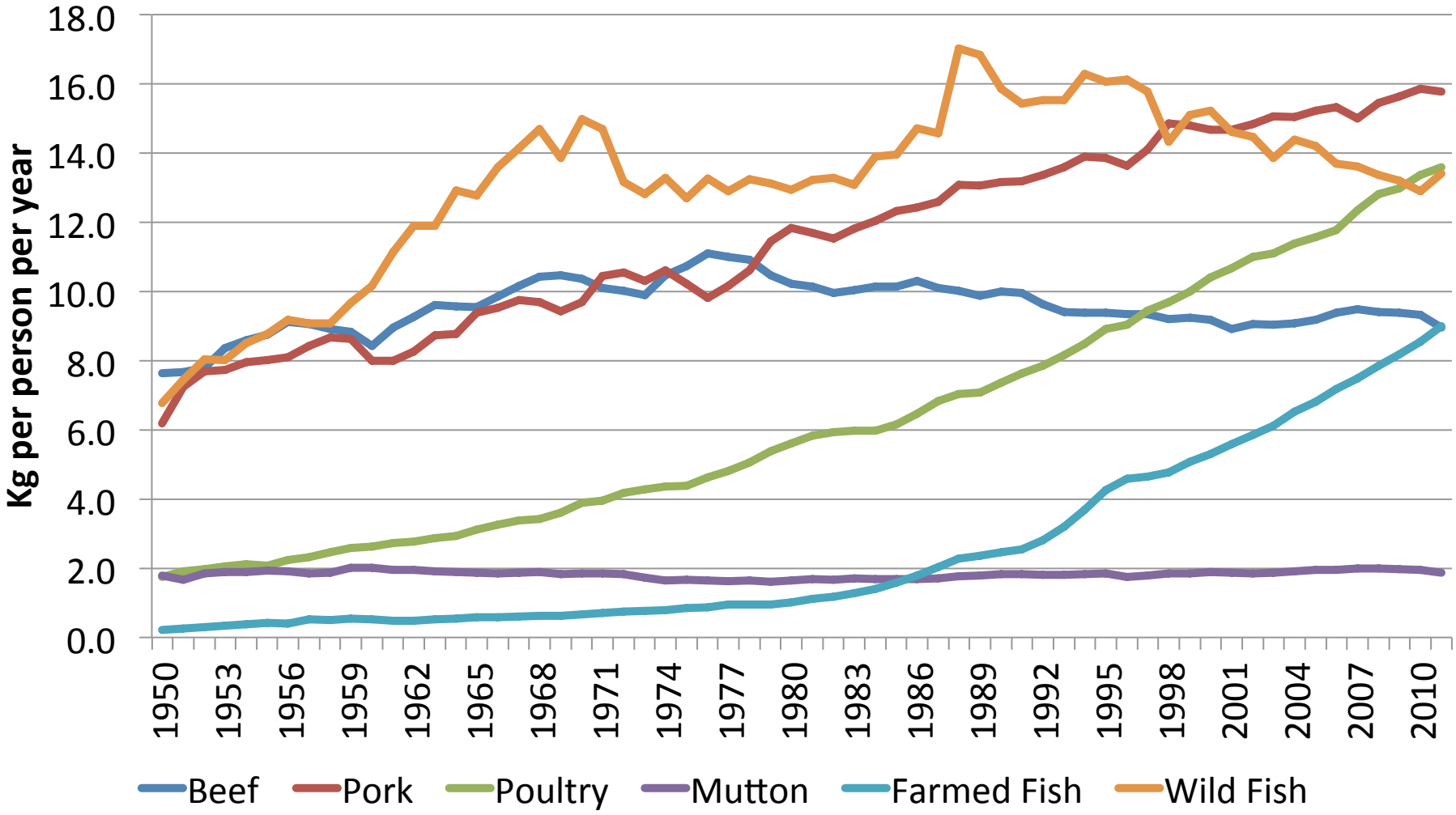
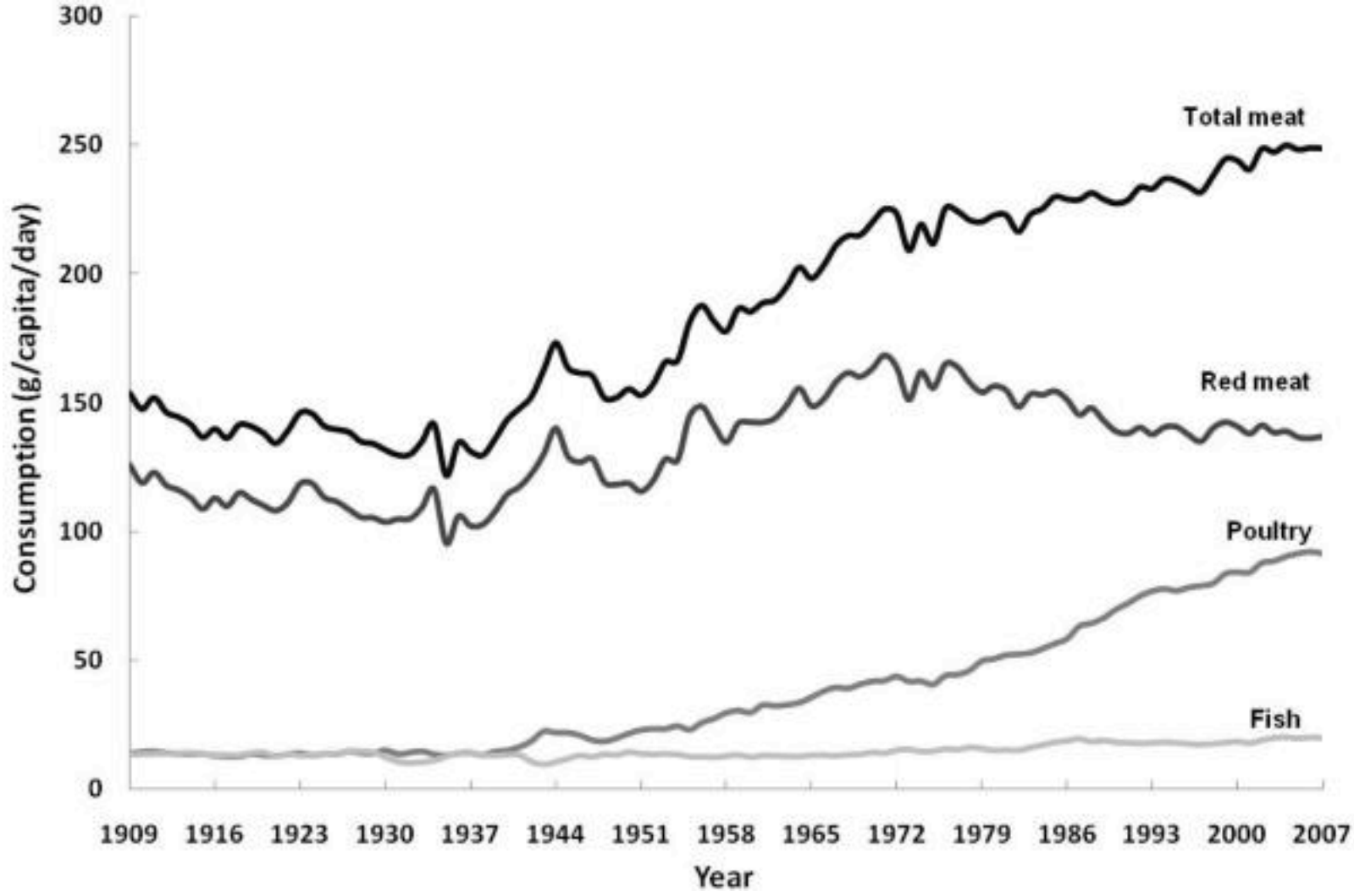
Global meat and fish availability per person 1950 to 2011



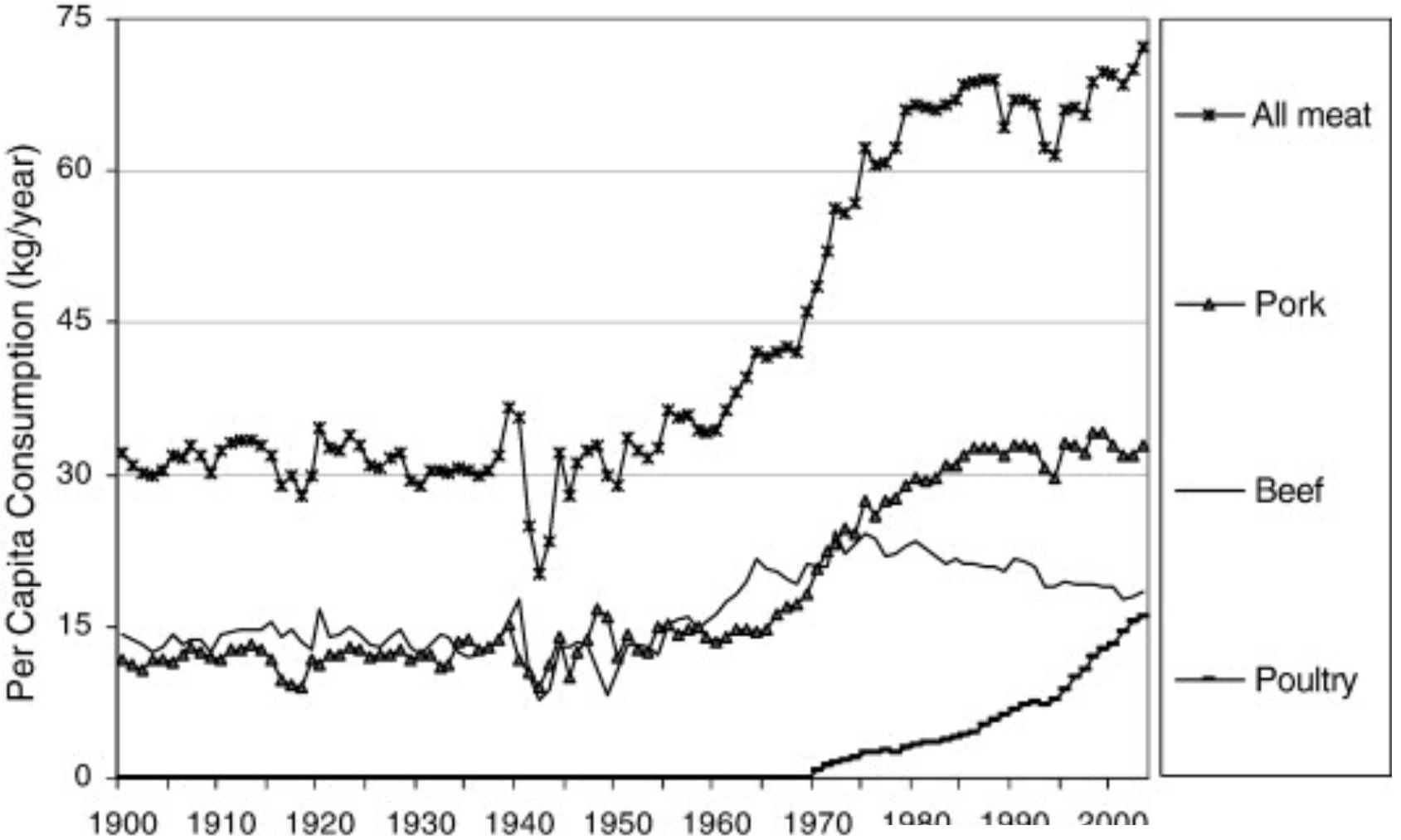
Source: http://www.earth-policy.org/data_center/C24 based on FAOSTAT data

US consumption 1909 to 2007



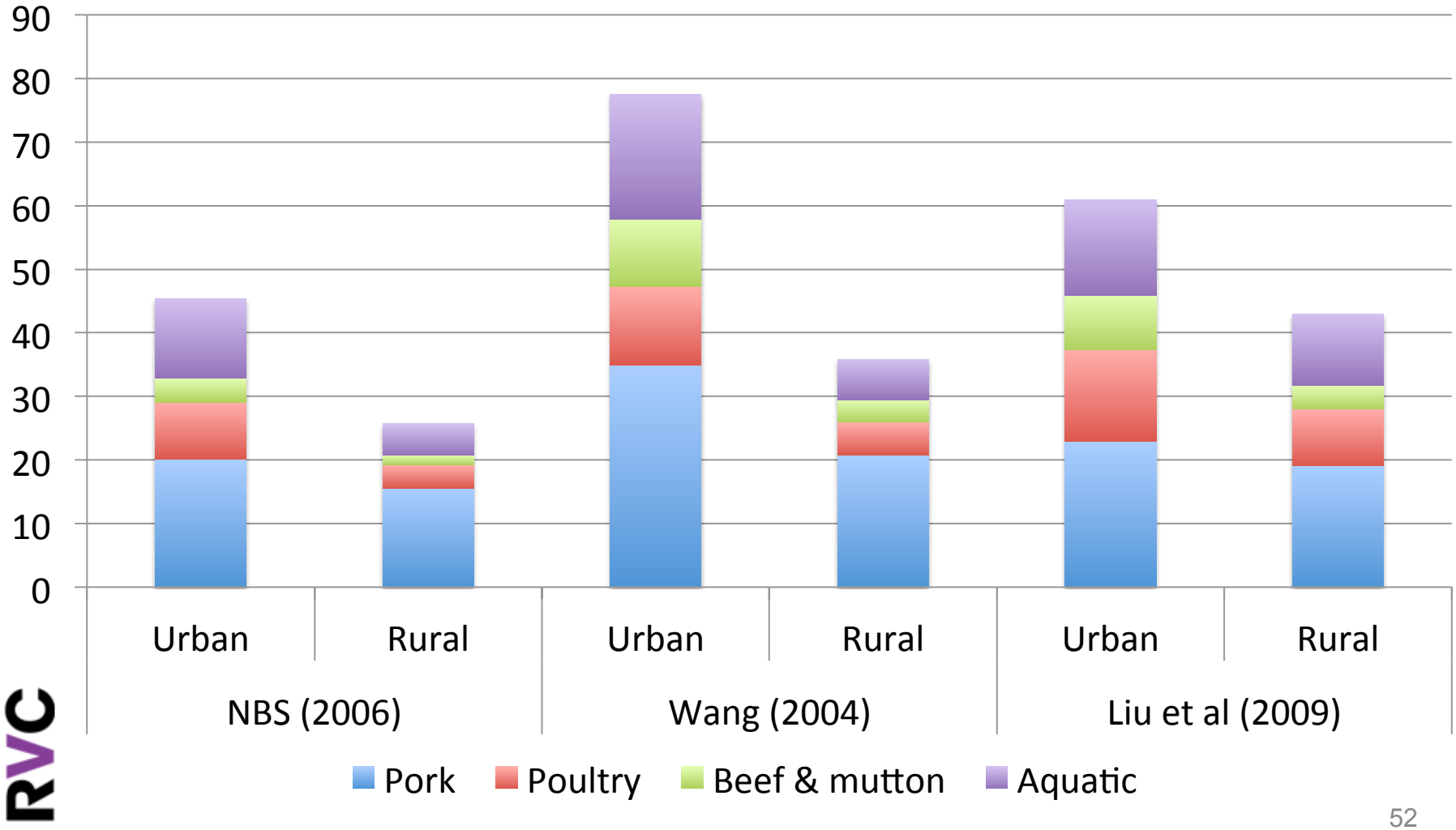
Daniel et al (2011)

Finnish meat consumption 1900 to 2000



Source Vinnari, (2008)

Estimates of Chinese consumption of pork, poultry, beef, mutton and aquatic species - kg per person per year (Liu et al, 2009)



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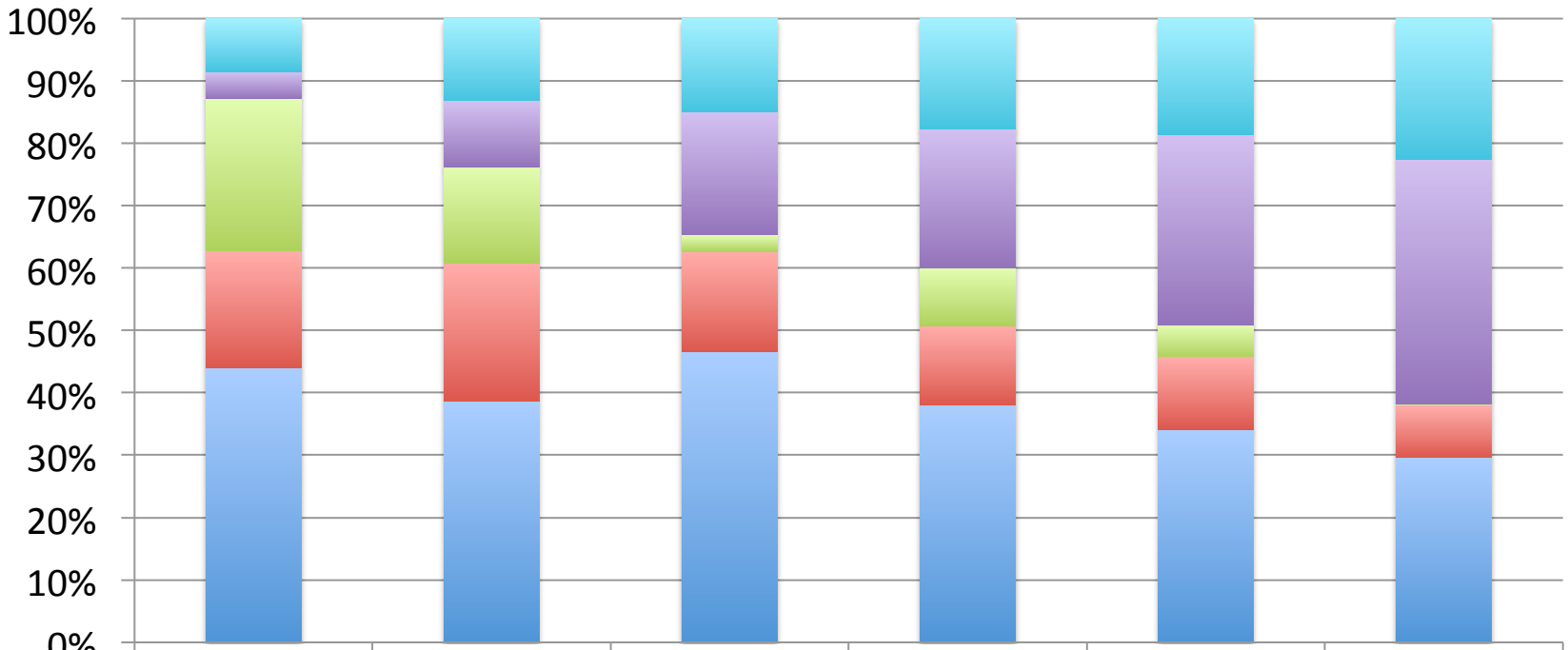
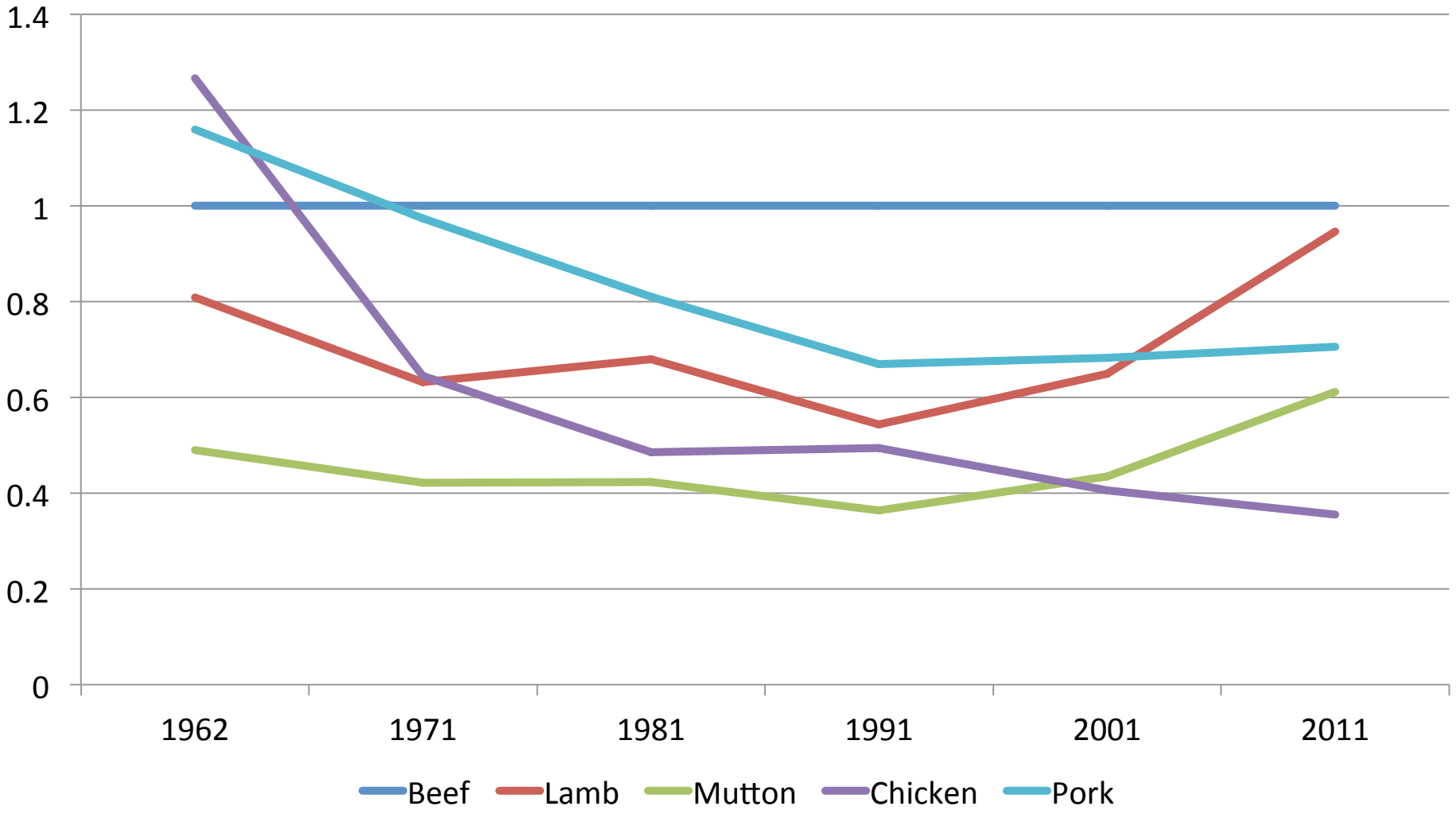
Meat consumption in Australia 1962-2011 (Wong et al, 2013)



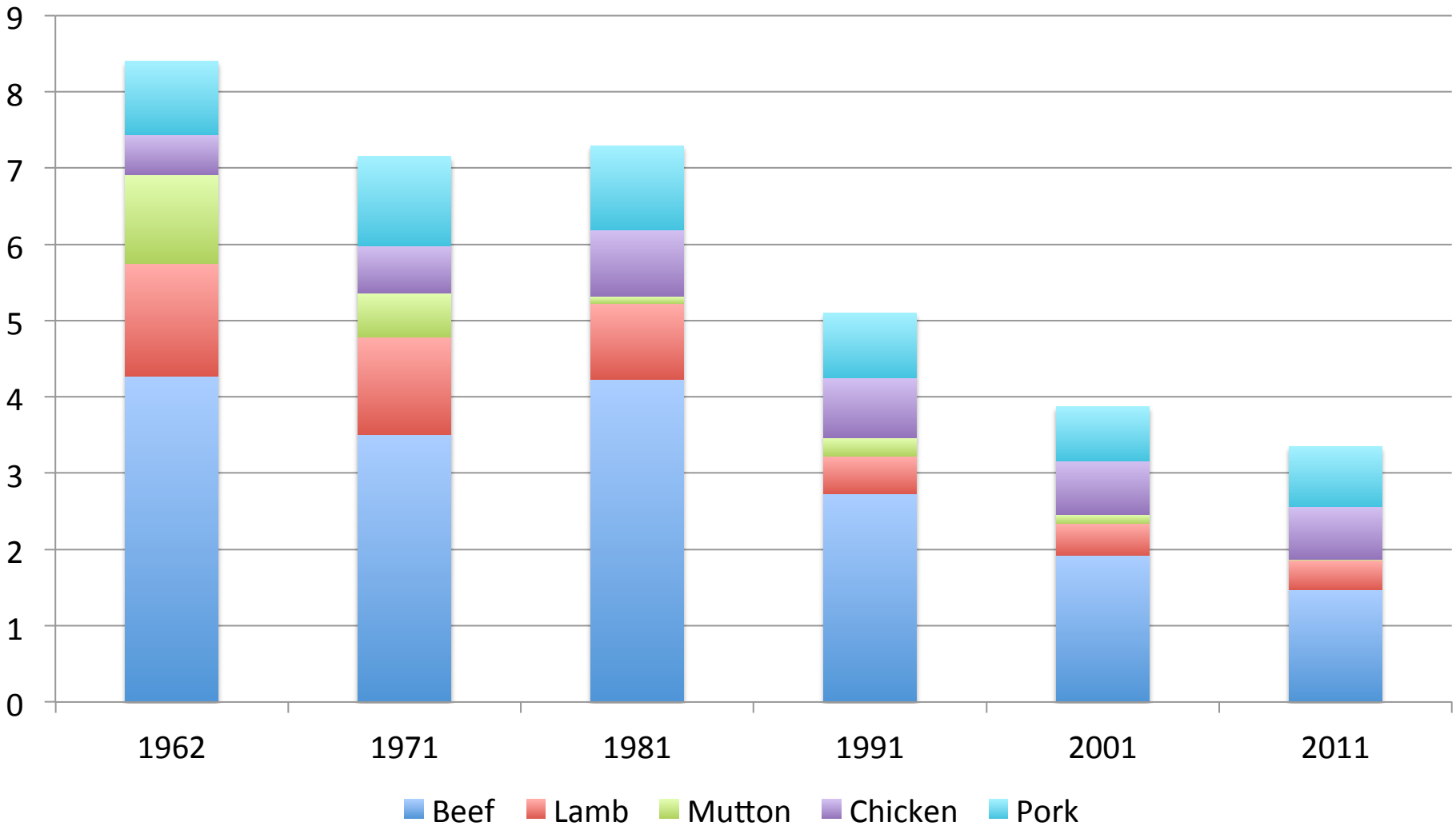
	1962	1971	1981	1991	2001	2011
Pork	8.8	13.8	15.3	18.4	18.8	25
Chicken	4.44	11.1	20.2	23.1	30.9	43.3
Mutton	25.21	15.95	2.71	9.6	5.12	0.3
Lamb	19.3	23.14	16.49	13.2	11.75	9.2
Beef	45.3	40.3	47.6	39.5	34.5	32.8

Relative meat prices (Beef the base price)



Wong et al (2013) author analysis

Share of meat in the Australian expenditure 1962-2011 (Wong et al, 2013)



Shift to grain based systems of livestock production – the benefits

- The shift to the raising of livestock in intensive grain based systems has been to reduce the relative costs of meat, milk and eggs
- From a societal perspective this has been a huge gain as people have been able to eat more livestock products at a lower relative price to other goods
- However these systems are reliant on very high levels of animal health
- They are also reliant on antimicrobials to achieve growth and fertility performance levels and to maintain healthy animals

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Market failure

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Market prices

- Market prices are a good indication of the costs of making and distributing a good or service
- However, these prices do not always cover all aspects of the costs or benefits of goods and services

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Where markets fail

- If the prices for goods and services either do not exist (no market) or inadequately cover their true costs there is market failure
- If this impacts on others across society there is a generation of externalities which can be both negative and positive
- Estimating the level of difference between the market price and the true cost is important for an economic analysis

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Methods to estimate prices

- **Price of alternatives**
  - Some good have alternatives such tractors for draught animals
- **Estimation from production function analysis**
  - Calculated through assessing the relationship between inputs and outputs
- **Hedonic pricing**
  - Estimating the components of a price regarding their particularly qualities – this requires large datasets
- **Contingent valuation** (willingness to pay)
  - Surveys are conducted with estimates of what people are willing to pay for a product or service with certain attributes

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Market Prices

- Market prices are a good starting point to value a good or resource in society
- However the price of a good or service needs to be compared to other goods and services in society and needs to compared to levels of income
- Market prices do not always reflect the true cost (or benefits) from their use (or production)
- There are a number of methods available to address these

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Estimates:
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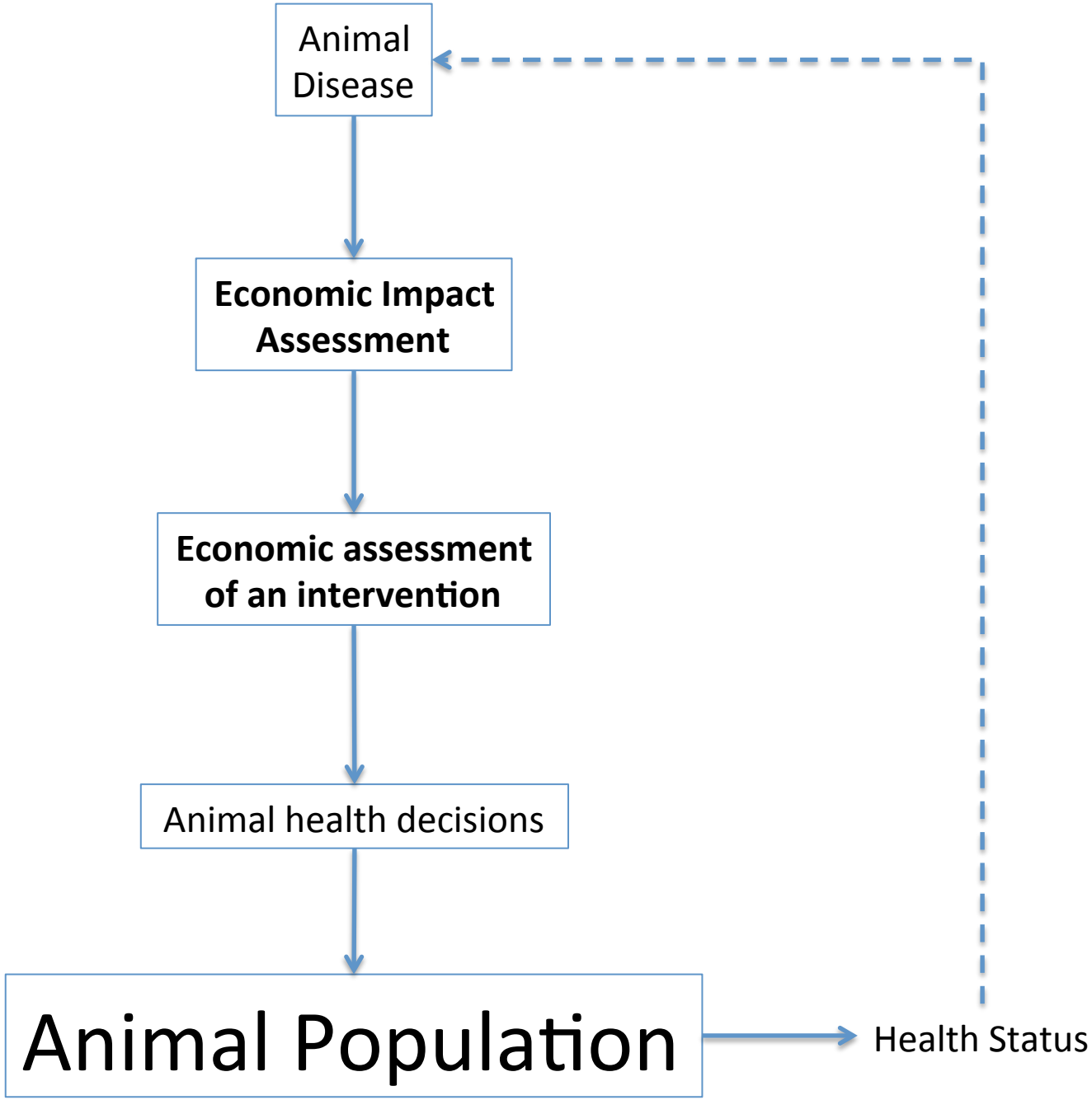

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Two examples of distortions in the market

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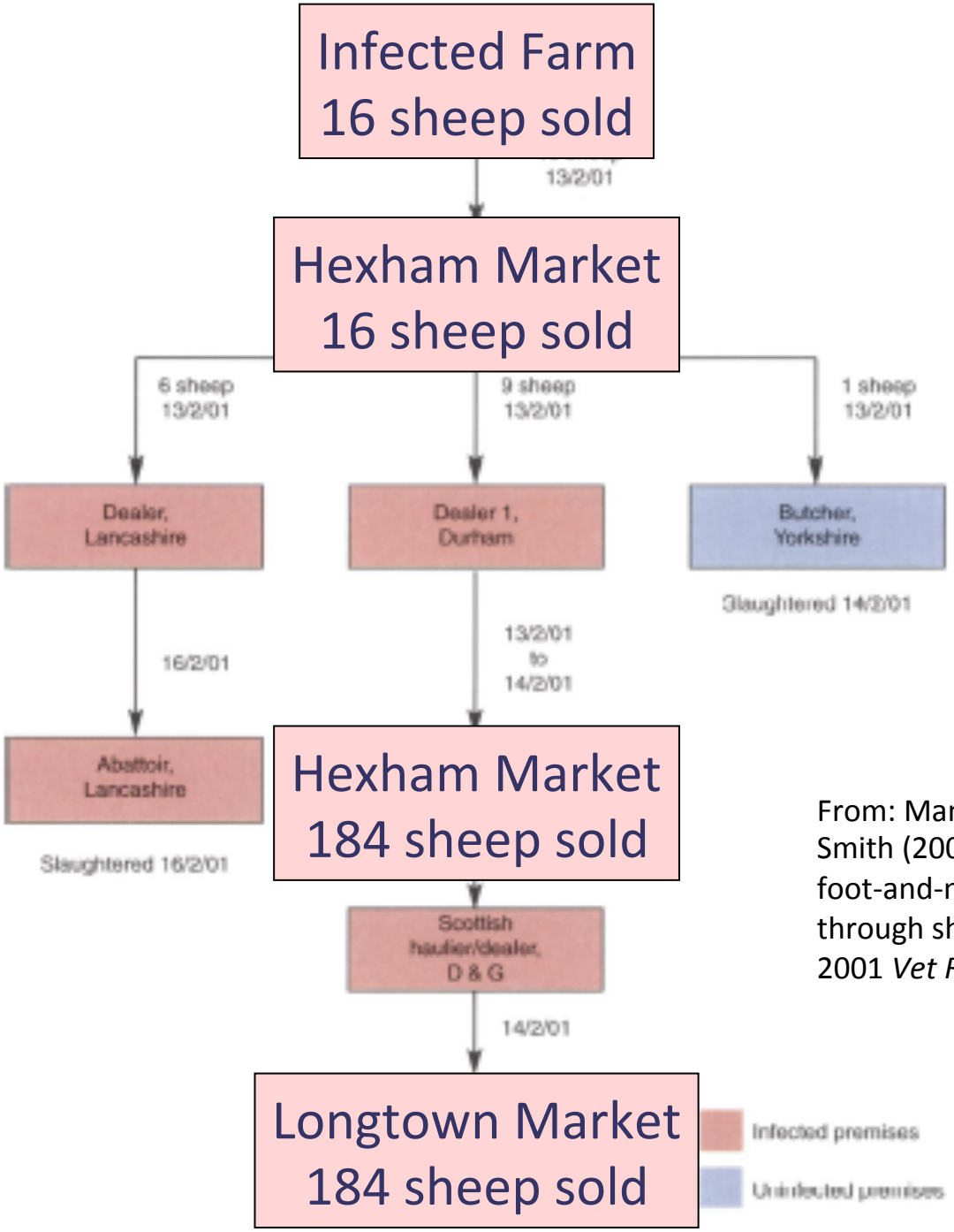

From: Mansley, Dunlop, Whiteside & Smith (2003) Early dissemination of foot-and-mouth disease virus through sheep marketing in February 2001 *Vet Rec* 153 pp 43-50

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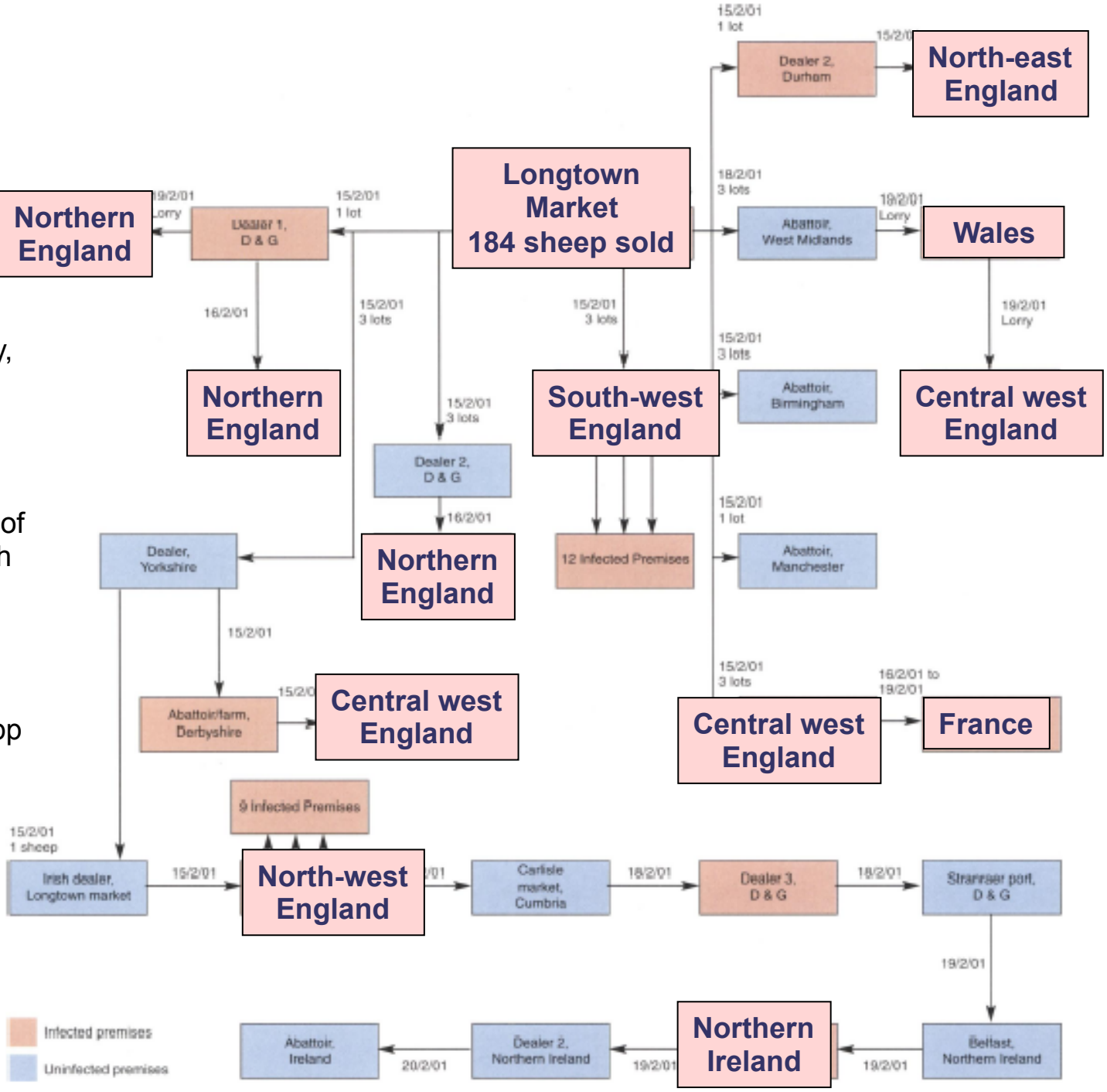

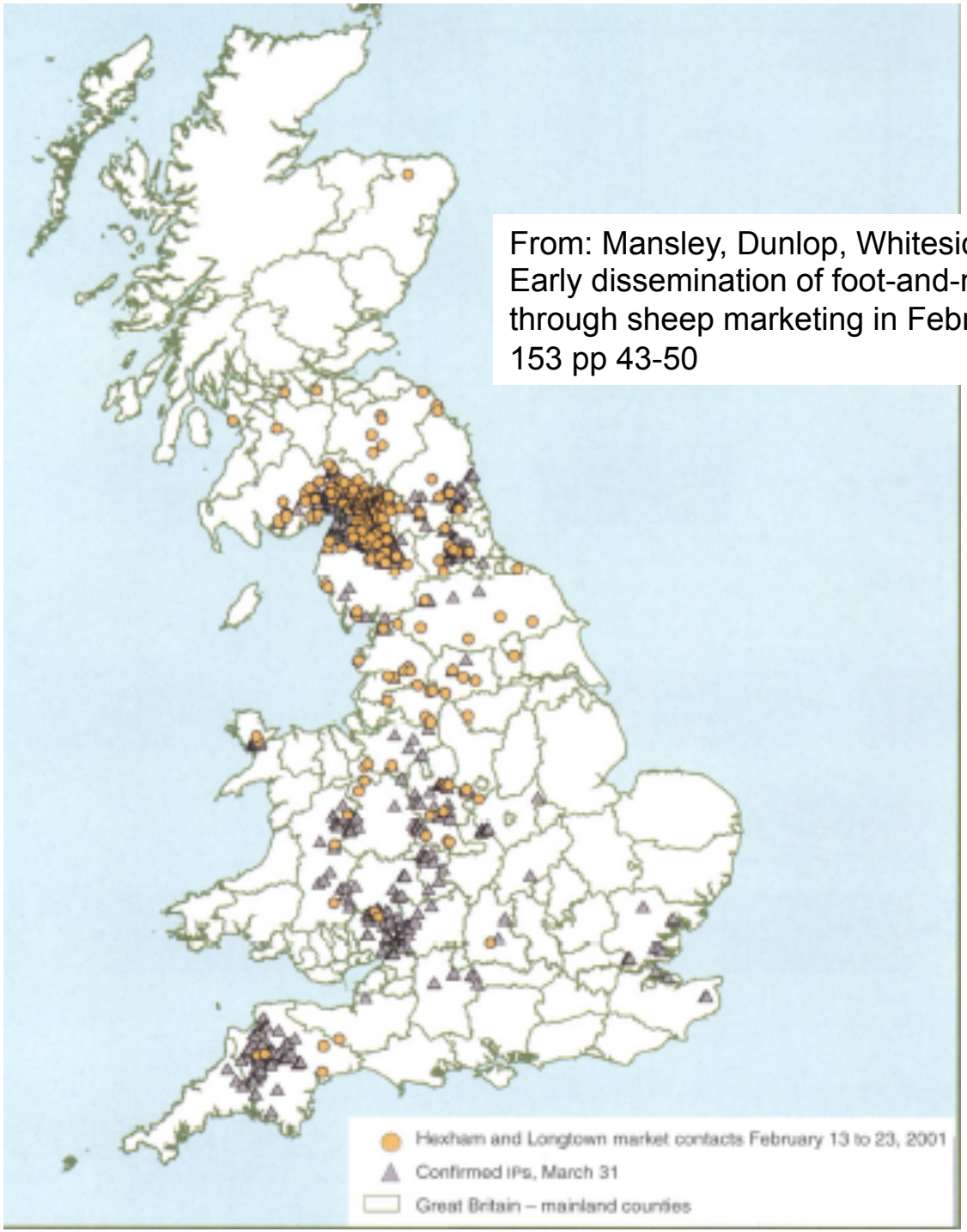

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FMD video

- Have a look at the following You Tube link to see how FMD can affect markets and the lives of poor people in Africa:
- http://www.youtube.com/watch?v=9oH6wBlEZiU

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BSE – 80s, 90s, 00s

- Rendering had traditionally been done by independent companies
- However, a company began to create a monopoly across the UK and changed the rendering process
- BSE emerged in cattle in the 80s, but was not recognised as a possible threat to humans until 1996
- The contaminated meat and bone meal from the UK was spread globally and has proved to be an accurate predictor of BSE
- The world, and in particular the UK, was lucky with BSE

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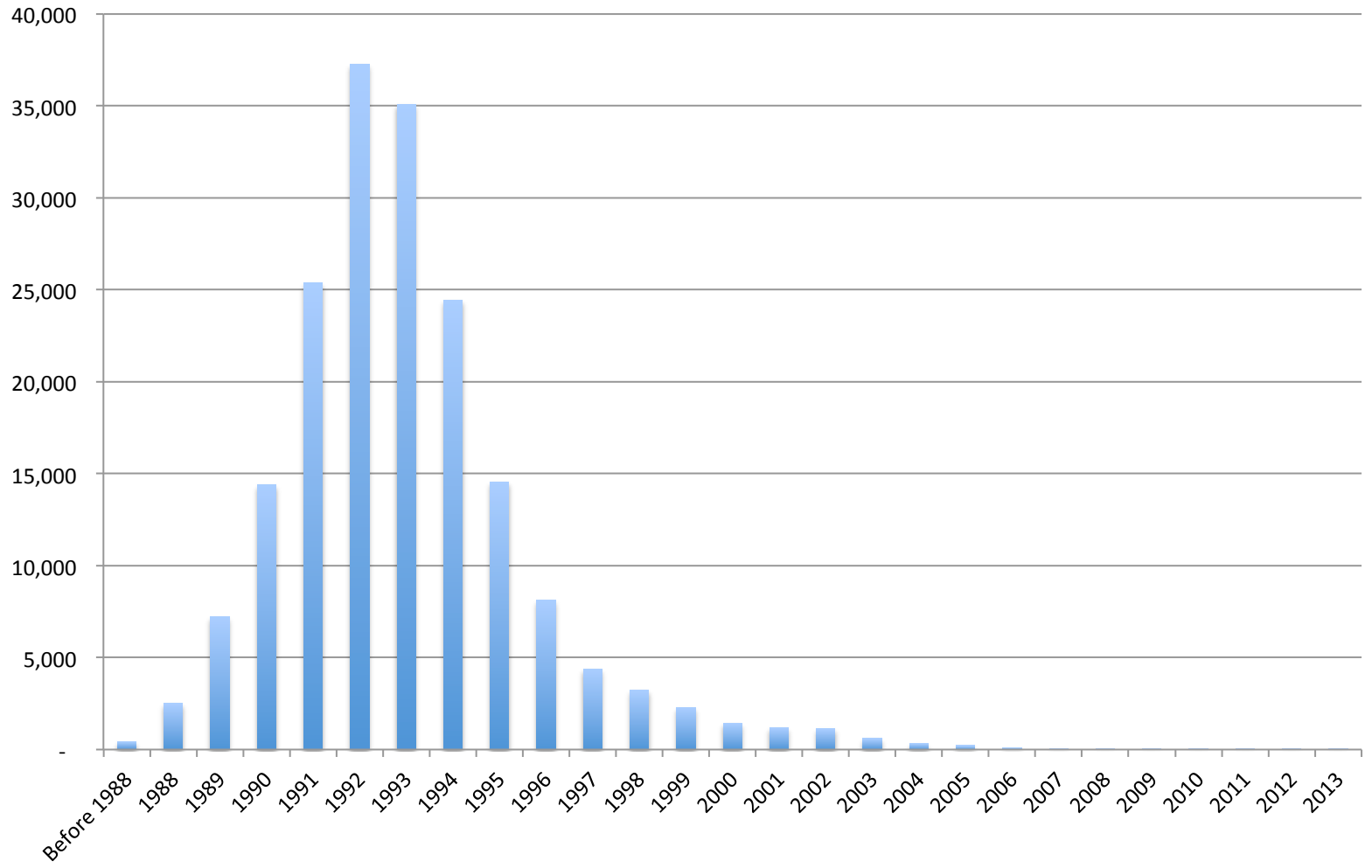
Confirmed BSE cases in the UK 1988 to 2013



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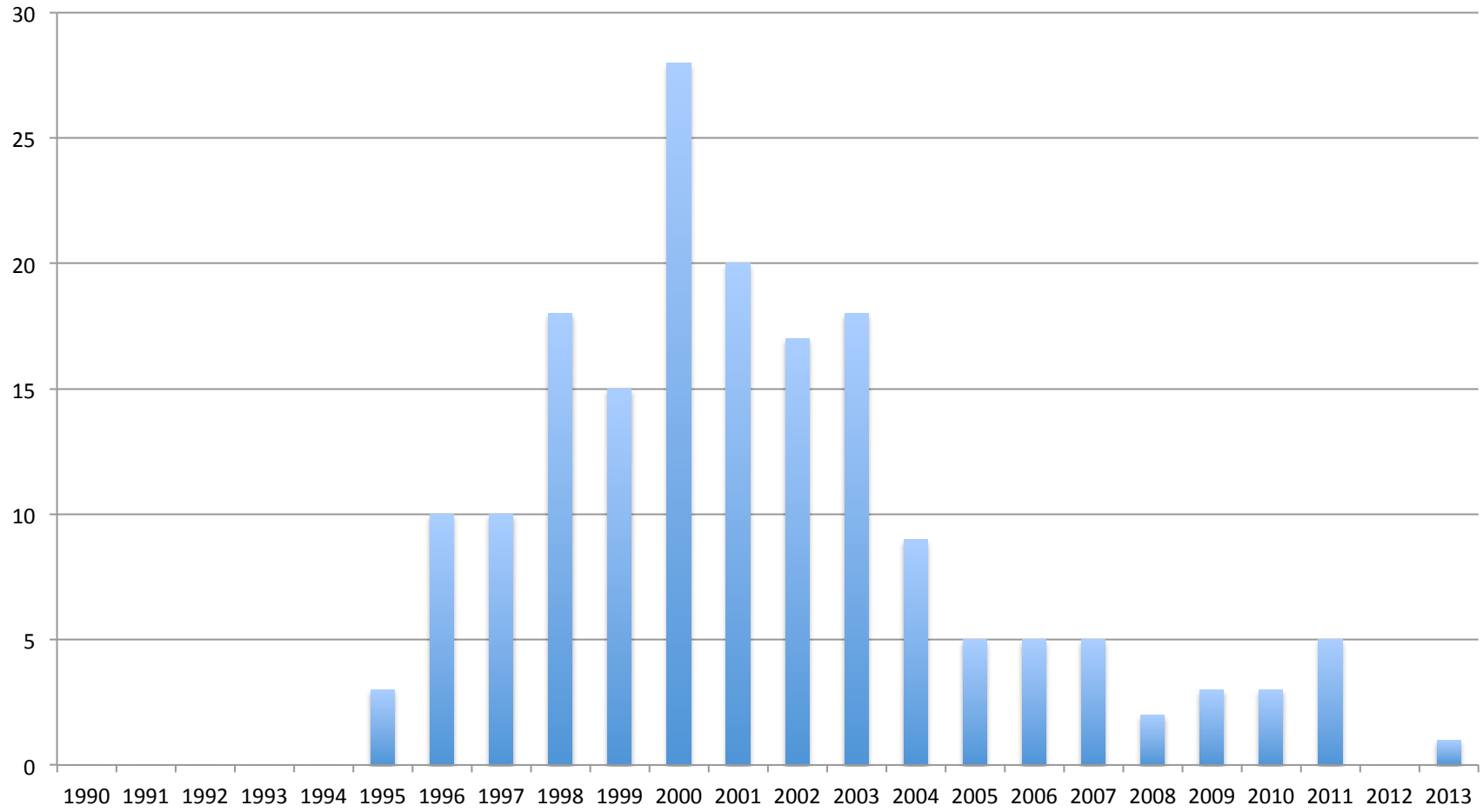
Confirmed vCJD in the UK 1990 to 2013



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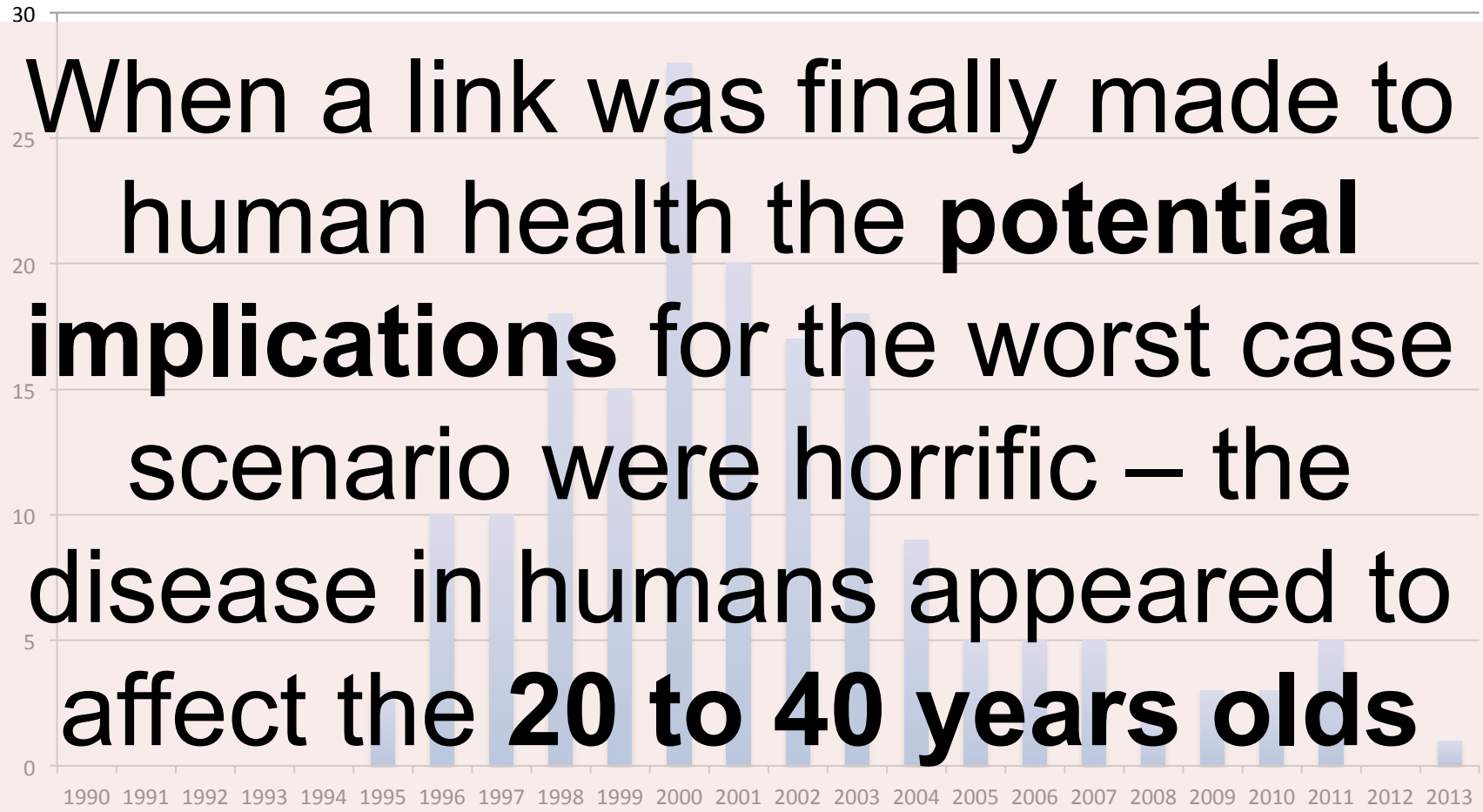
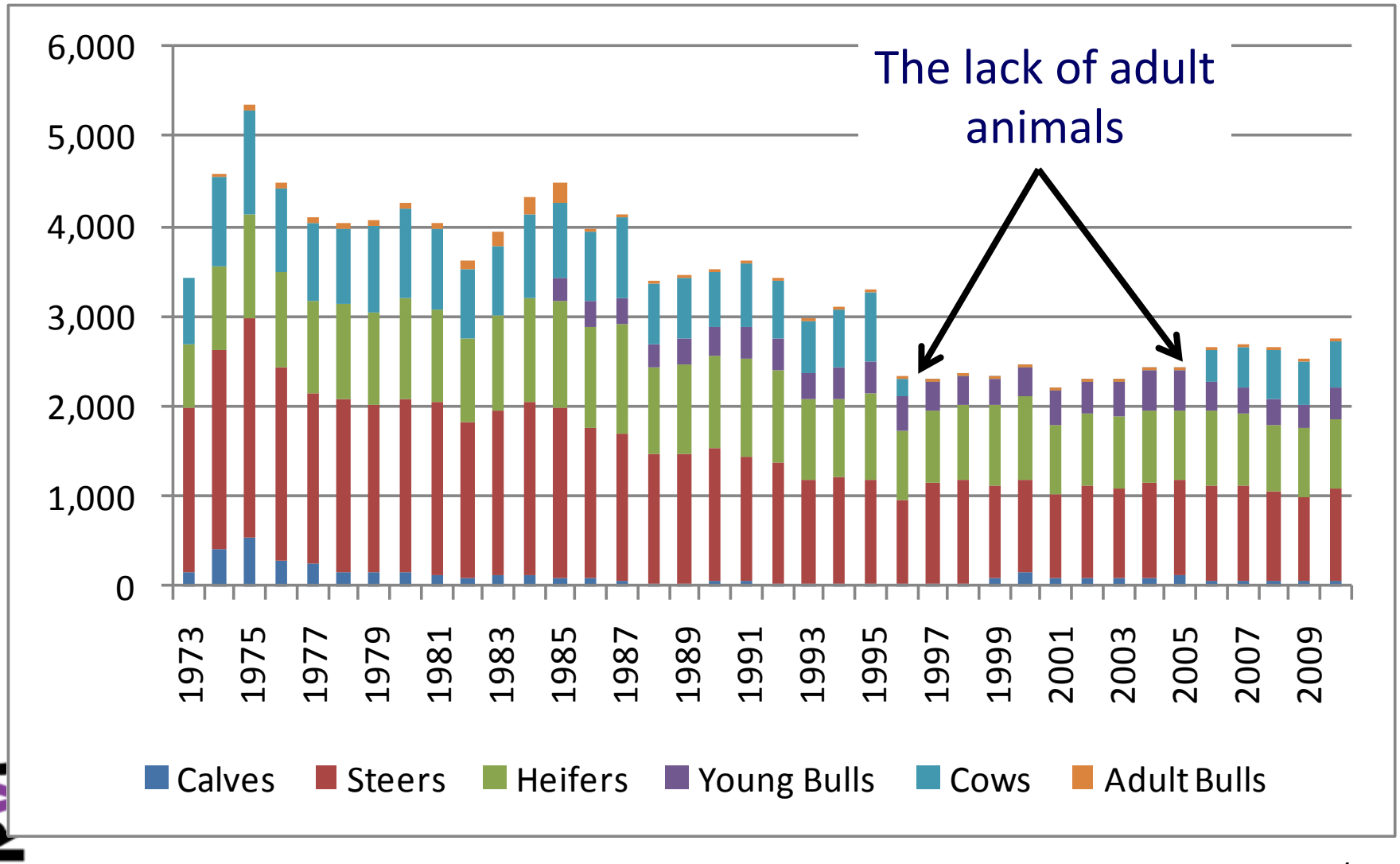


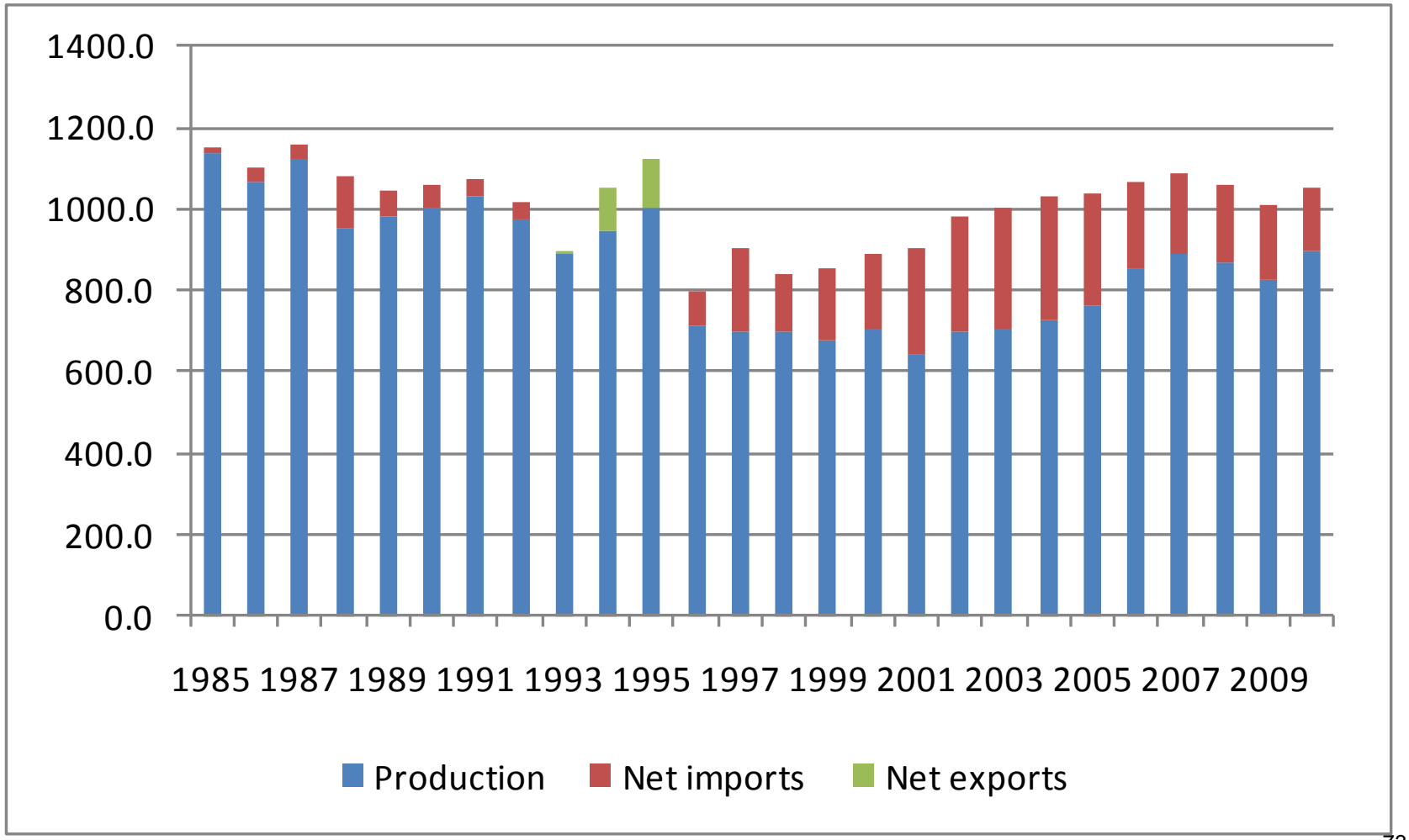
When a link was finally made to human health the **potential implications** for the worst case scenario were horrific – the disease in humans appeared to affect the **20 to 40 years olds**

Slaughter of all cattle by type 1973 to 2010



Source: DEFRA (2011)

Supply of beef in the UK 1985 to 2010 (DEFRA, 2011)



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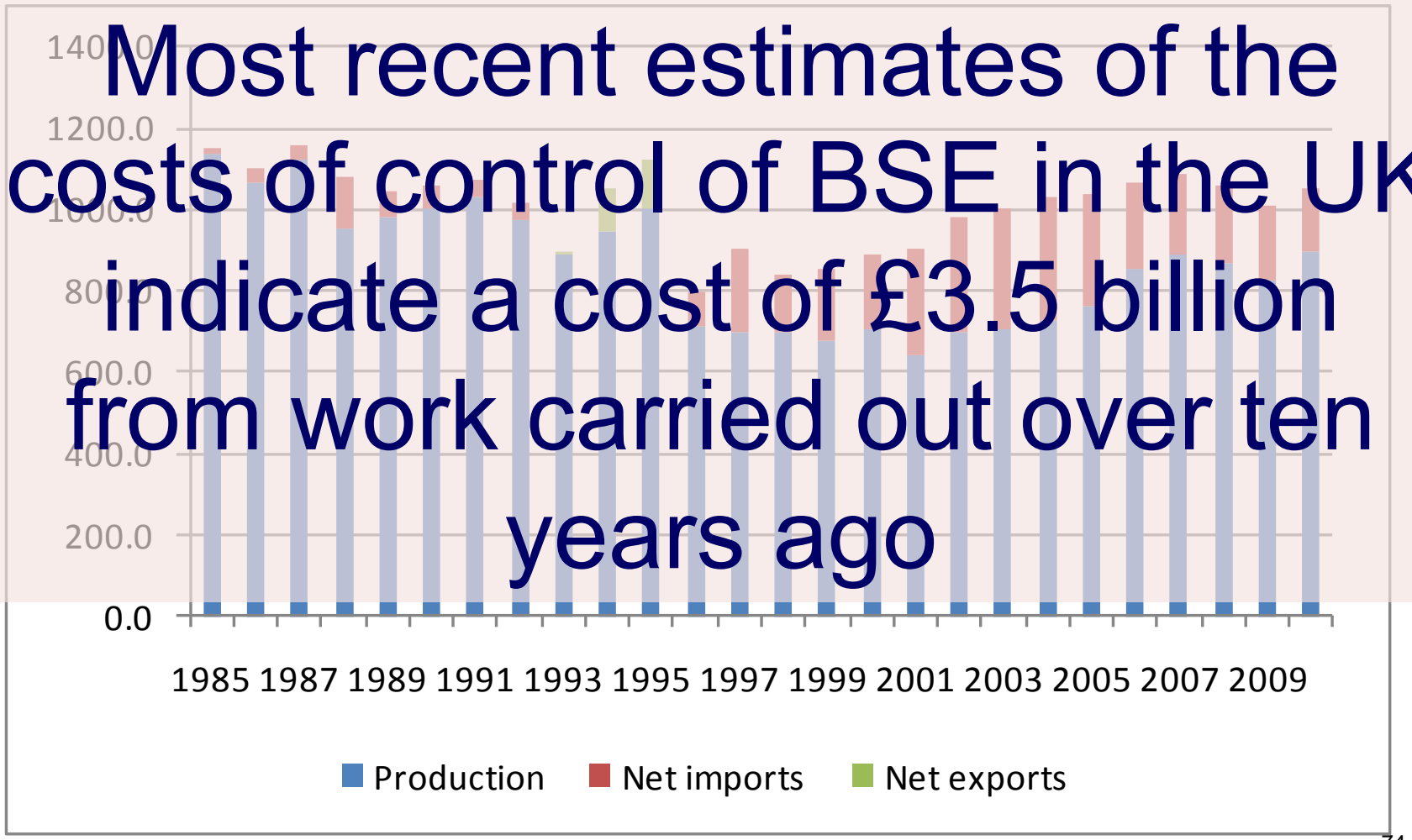

Most recent estimates of the costs of control of BSE in the UK indicate a cost of £3.5 billion from work carried out over ten years ago

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Reflections on the use of economics in animal health

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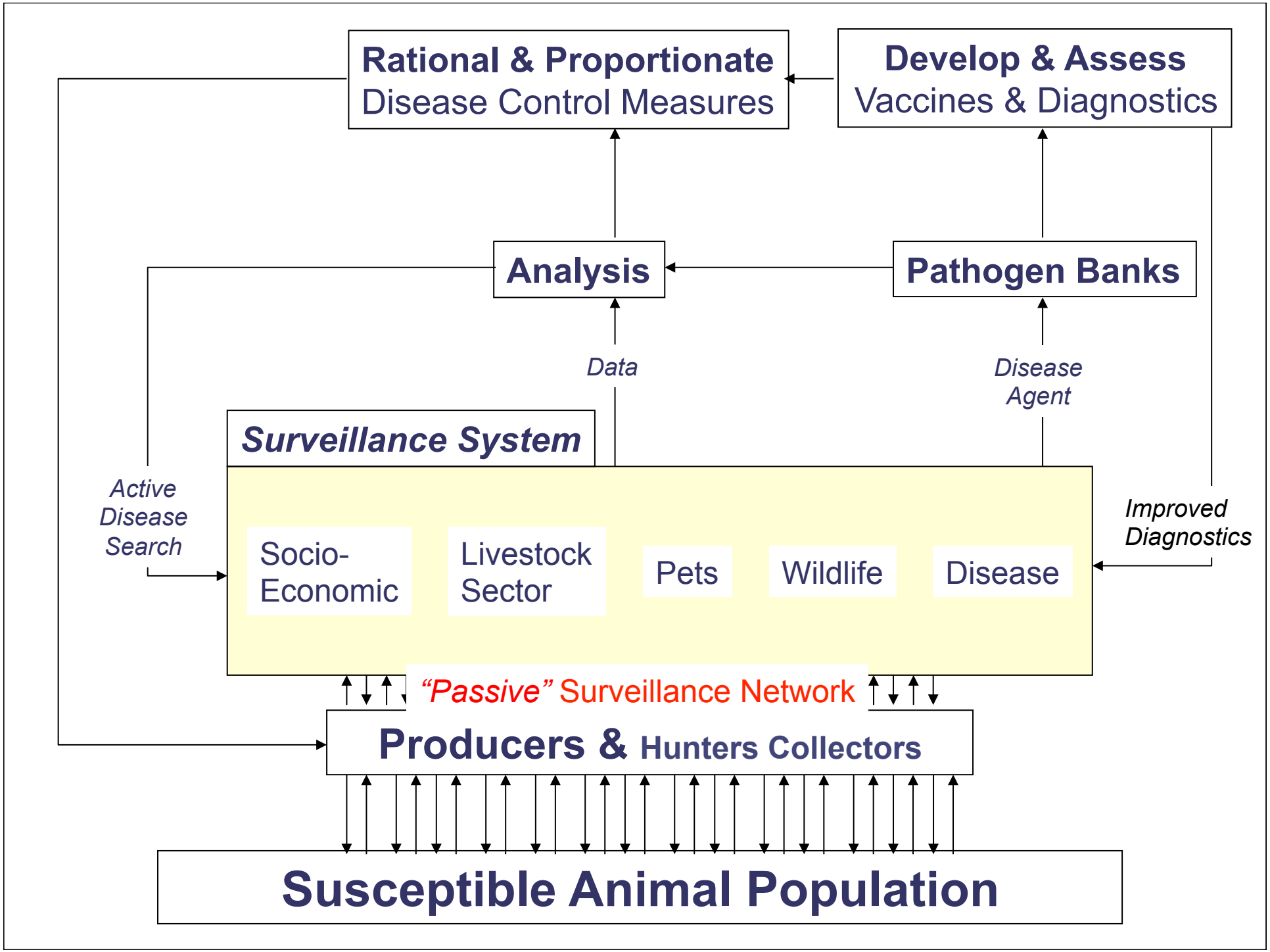
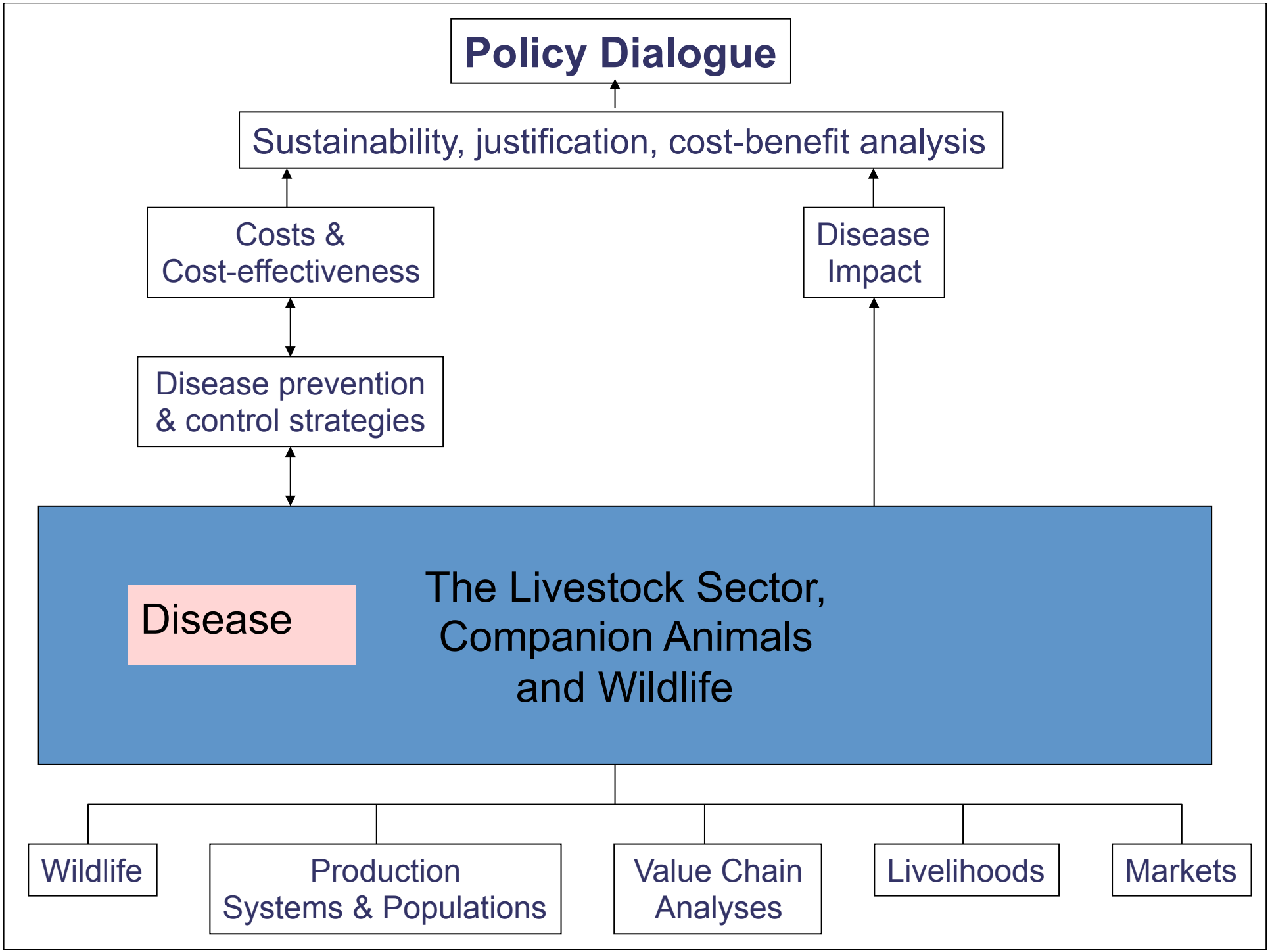

Rational & Proportionate
Disease Control Measures
Develop & Assess
Vaccines & Diagnostics
Analysis
Pathogen Banks
Data
Disease
Agent
Surveillance System
Active
Disease
Search
Socio-
Economic
Livestock
Sector
Pets
Wildlife
Disease
Improved
Diagnostics
"Passive" Surveillance Network
Producers & Hunters Collectors
Susceptible Animal Population


Policy Dialogue
Sustainability, justification, cost-benefit analysis
Costs & Cost-effectiveness
Disease Impact
Disease prevention & control strategies
Disease
The Livestock Sector, Companion Animals and Wildlife
Wildlife
Production Systems & Populations
Value Chain Analyses
Livelihoods
Markets

A new society

- International Society for Economics and Social Science of Animal Health
- We will hold a first meeting for a day before SVEPM in Inverness in March 2017
- We will be inviting papers and posters to cut across the animal health, economics and social sciences
- We want to create a bridge

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Further information

- For more information on NEAT please look at
  - www.neat-network.eu
- For information on NEOH please look at
  - http://neoh.onehealthglobal.net
- For information on the work we are involved in with agriculture and health please look at
  - http://www.lcirah.ac.uk/home
- For courses offered at RVC please look at
  - http://www.rvc.ac.uk/Postgraduate/Distance/Index.cfm
  - http://www.atp-ilhp.org

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Reading

- Bonanni, P.; Picazo, J.J.; Rémy, V. (2015) The intangible benefits of vaccination what is the true economic value of vaccination? Journal of Market Access and Health Policy **3:** 26964
- Lee, B.Y.; McGlone, S.M. (2010) Pricing of new vaccines. Human Vaccines 6:8, 619-626
- Robert, M.; Hu, W.; Nielsen, M.K.; Stowe, C.J. (2014) Attitudes towards implementation of surveillance-based parasite control on Kentucky Thoroughbred farms – Current strategies, awareness and willingness-to-pay. Equine Veterinary Journal.
- Rushton, J. and Redmond, E.F. (2015) Application of economics to equine health and welfare. Equine Veterinary Journal, 47: 633–634. doi: 10.1111/evj.12510
- Smith, R. & Coast (2013) The true cost of antimicrobial resistance. BMJ 2013;346:f1493
- C. Jill Stowe and Billy Ajello (2010) A Hedonic Price Analysis of Differentiated Products of Unknown Quality: Freshman Sire Stud Fees in the Thoroughbred Breeding Industry. Journal of Agribusiness 28,1 19-30

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