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Making effective economic assessments of animal health interventions

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Southern African Society Veterinary Epidemiology & Preventive Medicine
14th Annual Congress
24-26 August 2016
Cape Town, South Africa

Introduction

- Yesterday I covered in some detail the impact of a disease or health problem
- This created a **baseline** of what is know about the production losses, expenditure on surveillance, prevention and control and wider aspects of markets
- The information generated allows **prioritisation** of animal health problems

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Introduction

- It raises questions on the allocation of resources within specific disease control programmes
- And allows an investigation of inter and intra disease allocations
- This will prompt questions of the **need for change**
- If this is done adequately there will be a need to assess the **economic consequences of a change**

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Introduction

- This morning I will focus on what I see as the **main economic tools** for assessing change
  - When they can be used
  - What the issues are in their application
- Before I go into these details I will present a background on **economic concepts** and searching for **economic optimal points**
- And I will end with some reflections on **compensation**

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Economic optimal areas of production

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Opportunity Cost

- Choice involves sacrifice for example:
  - The more food a **person** chooses to buy, the less money you will have to spend on other goods
  - The more money a **farmer** spends on veterinary advice the less money he has available for other inputs.
  - The more money spent on **veterinary practice** signboard the less money laboratory diagnosis equipment
  - The more money spent by a **veterinary faculty** the less money for support staff
  - When a **government** spends money on disease control it has less available for other projects

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Opportunity cost

- In other words, the production or consumption of one thing involves the sacrifice of alternatives.
- This sacrifice of alternatives in production (or consumption) of a good is known as its **OPPORTUNITY COST**

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Animal health decisions can be on biosecurity and animal health

Rational Choices

- Economists often refer to **rational choices**.
- This simply means the weighing-up of the costs and benefits of any activity.
- For example
  - A **student** deciding how much time to spend on a research project
  - A **farmer** deciding the feeding regime of their poultry,
  - A **veterinary practice** manager deciding whether to specialise in companion or large animals
  - A **government** determining the amount of investment in education

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Rational choices

- Knowing the cost of a decision is only part of the problem
- Rational decision making also requires information on the benefits
- It involves choosing what will give the best value for money, i.e. **the greatest benefit relative to cost**.

Poor decision makers often the know the cost of everything and the value of nothing!

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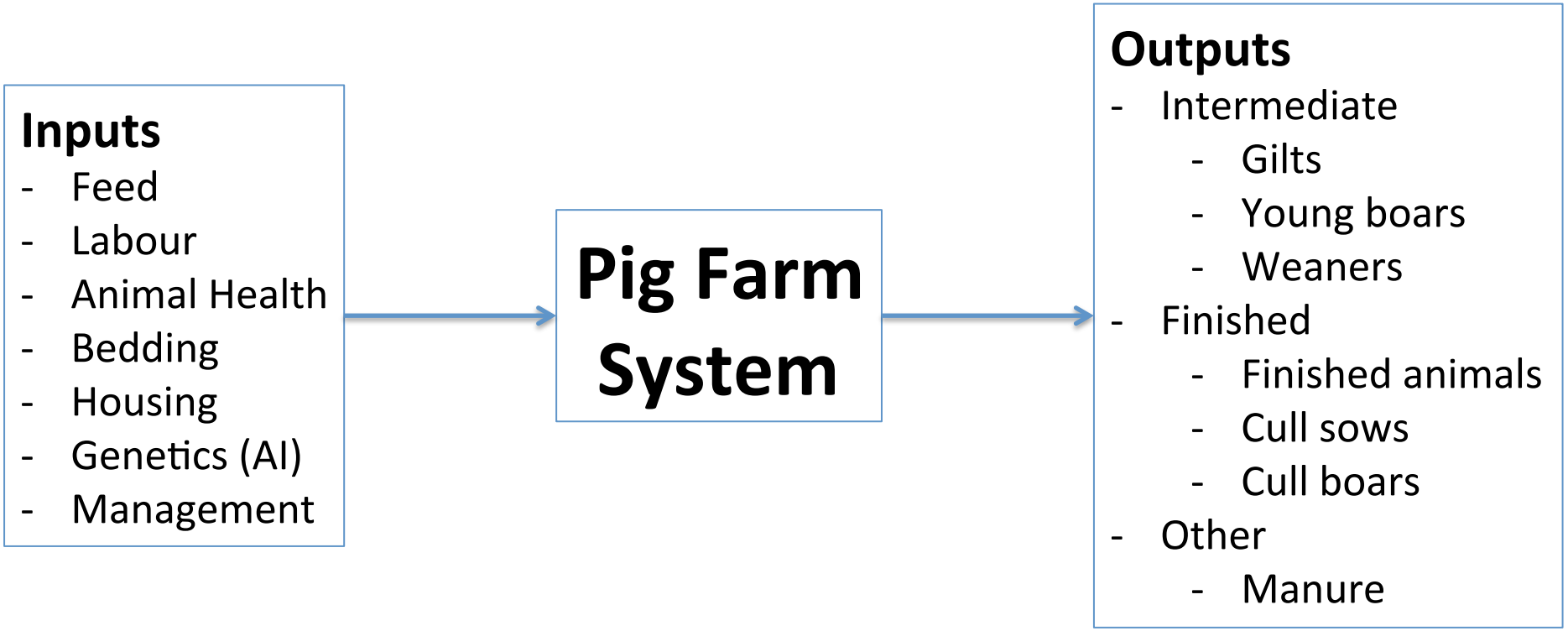
Decisions can be on investments to handle animal

Pig Production



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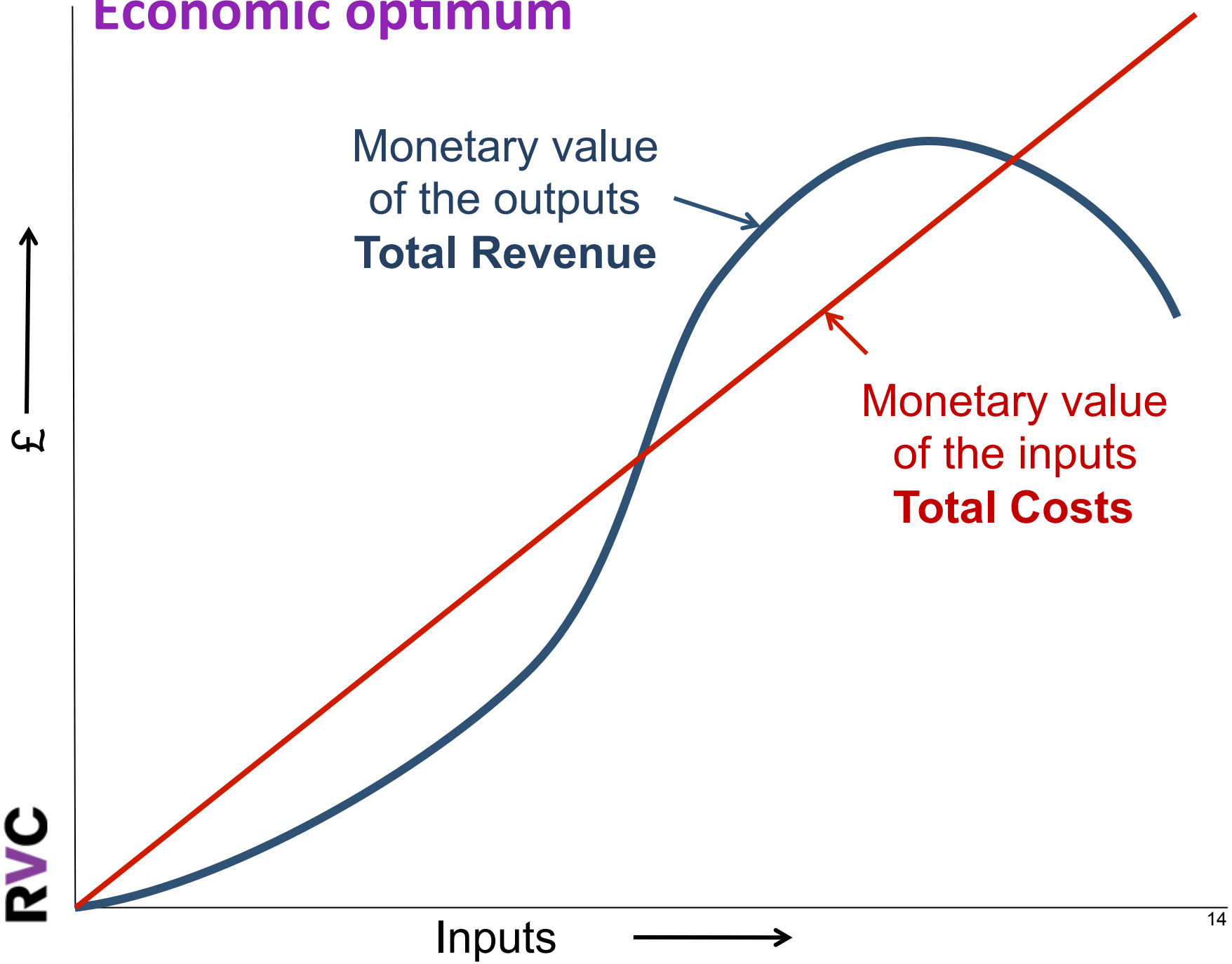
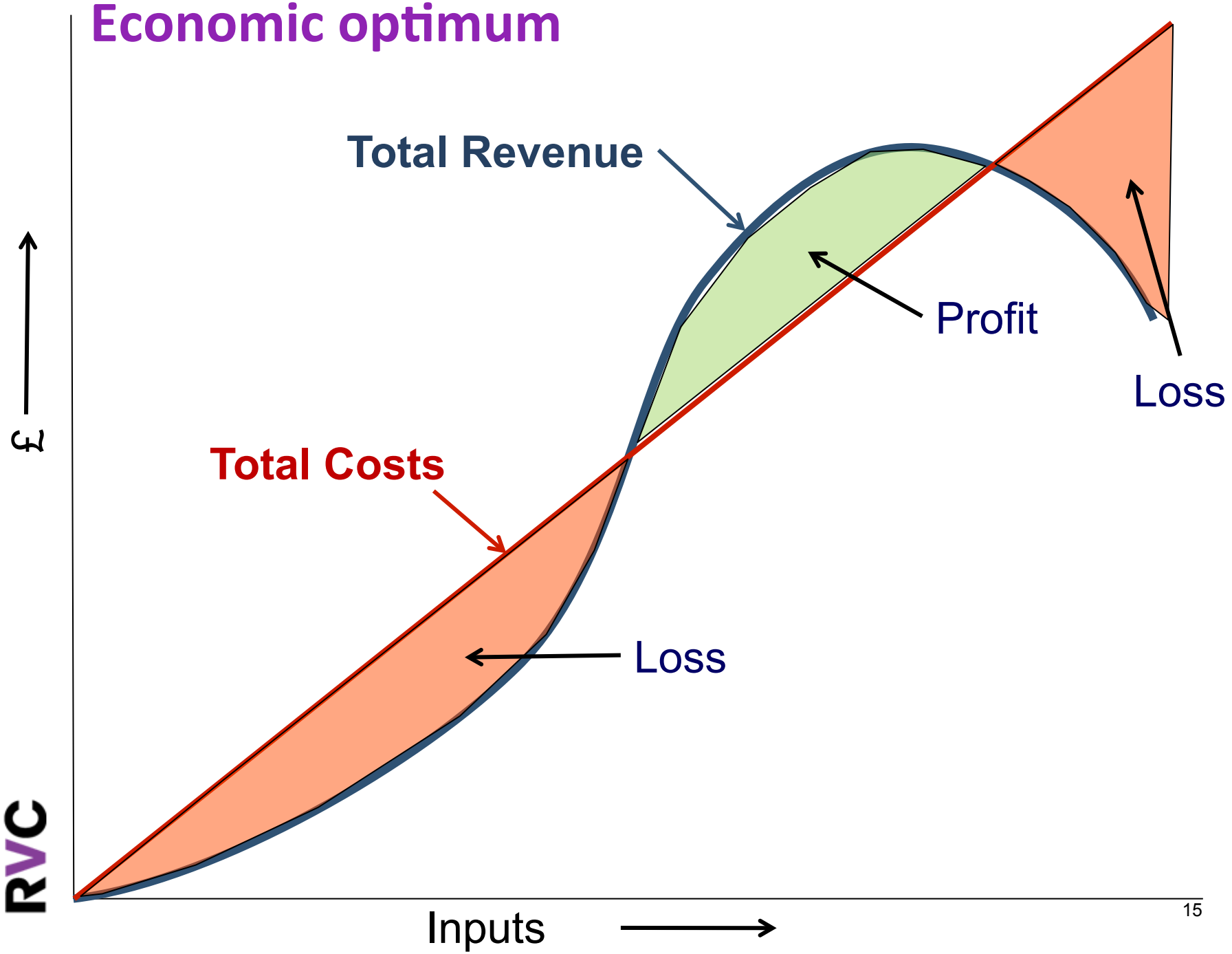
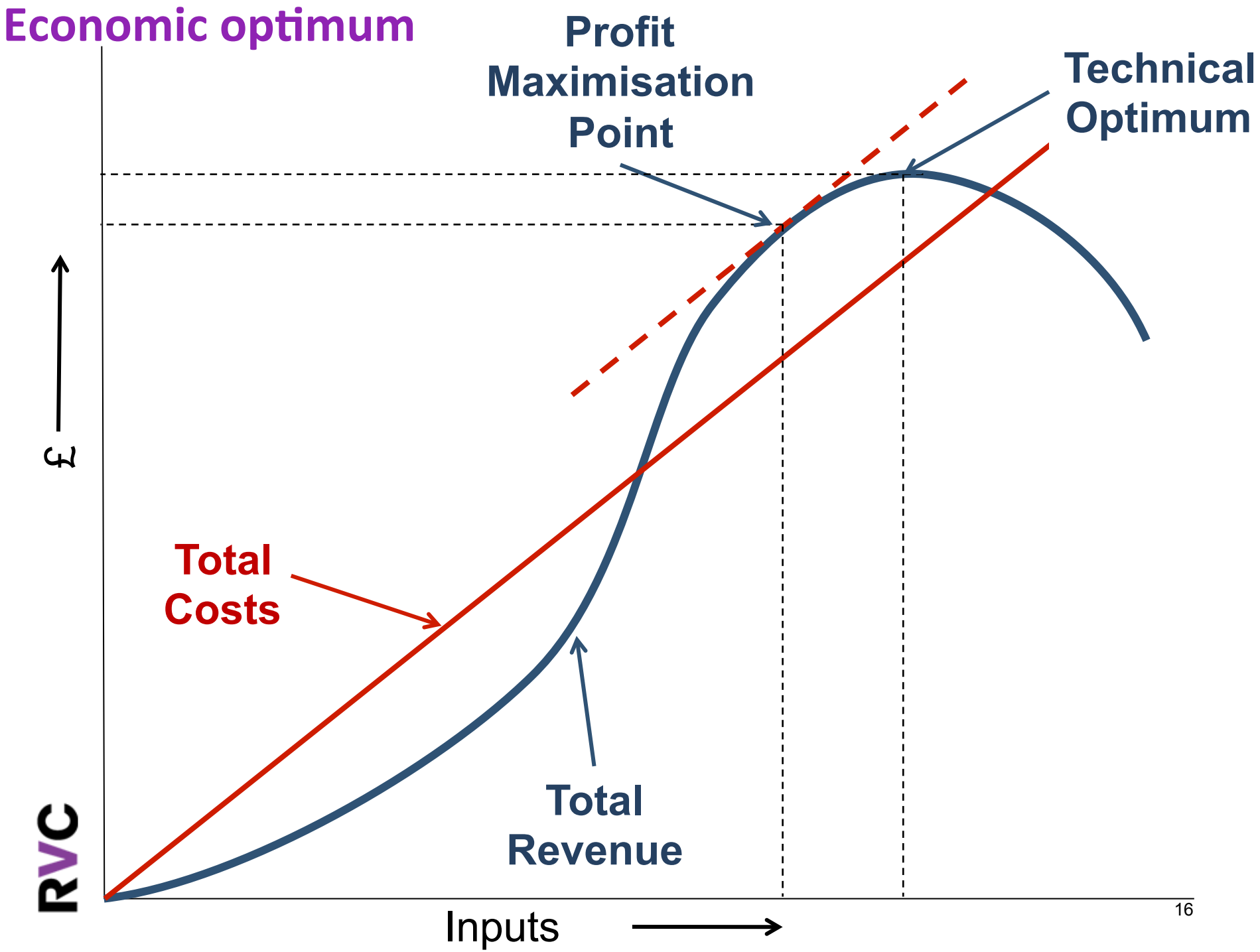
Outdoor pig system UK

Economic optimum



Economic optimum




Economic optimum
Profit Maximisation Point
Technical Optimum
£
Total Costs
Total Revenue
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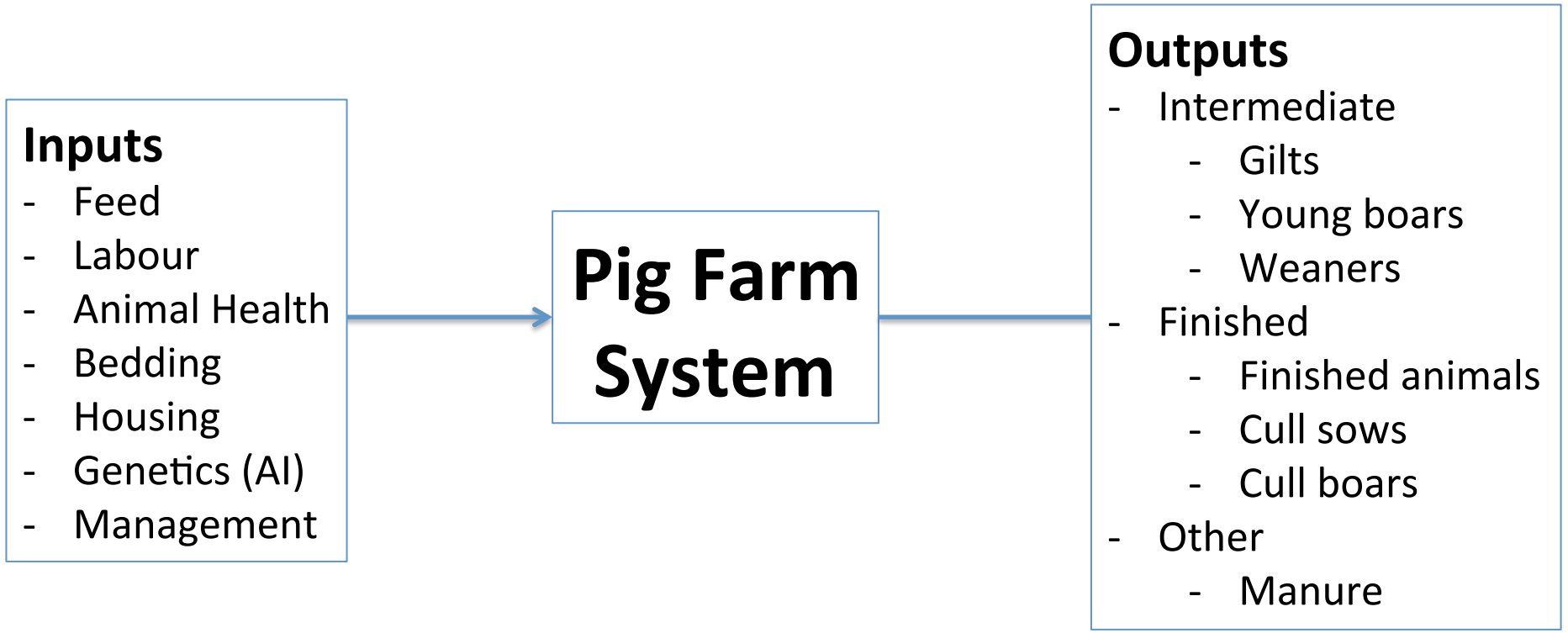
Inputs

Pig Production



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Pig Production Metrics

Pig Farm **Production** = Outputs

Pig Farm **Profit** = Outputs - Inputs

Pig Farm **Productivity** = $\frac{\text{Outputs}}{\text{Inputs}}$

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Important Rules of thumb

- These relationships are complex and rarely fully described by farm businesses or indeed academia
- So we reduce them down to **rules of thumb** (heuristics)
  - Key inputs – feed, capital
  - Key outputs – offspring, liveweight
- We generate **productivity proxies** such as:
  - Piglets per sow
  - Feed conversion ratio

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Important Rules of thumb

- These relationships are complex and rarely fully described by farm businesses or indeed academia

Critical to identify important inputs and outputs

Prices of key inputs and key outputs dictate profitability and productivity

- Piglets per sow
- Feed conversion ratio

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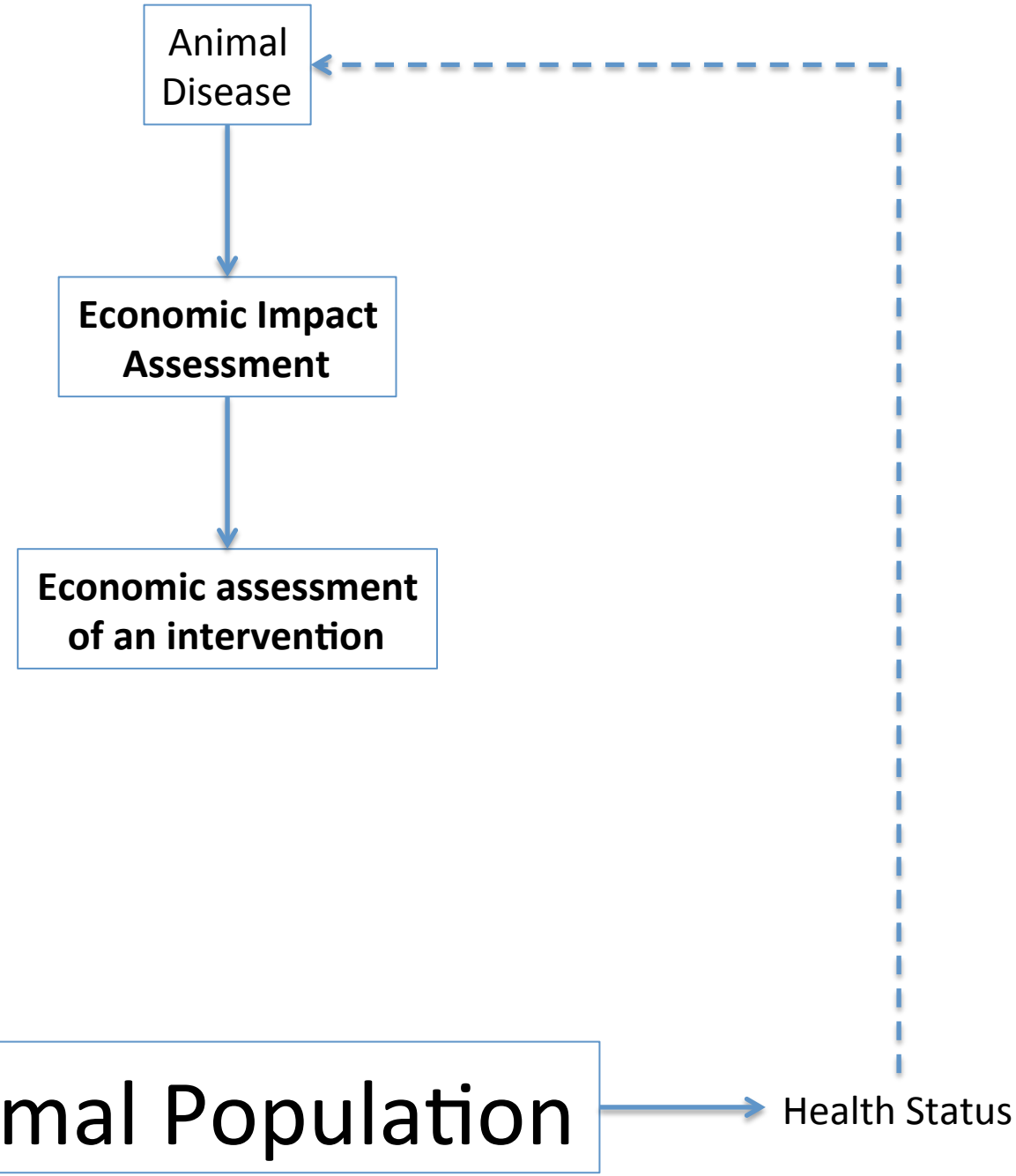
Data on:
- Scale – populations, farms
- Disease
- Parameters – fertility, mortality, sales
- Prices - markets



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Assessing Animal Health Interventions

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Assessing interventions and change

Economic tools

- **Partial Budget Analysis**
  - Short term animal health interventions
- **Cost Benefit Analysis**
  - Long term animal health interventions – major investments
- **Financial Feasibility**
  - Practical feasibility of financing an intervention
- **Decision Tree Analysis**
  - Forces the analyst to assess uncertain and quantify the risks of the intervention

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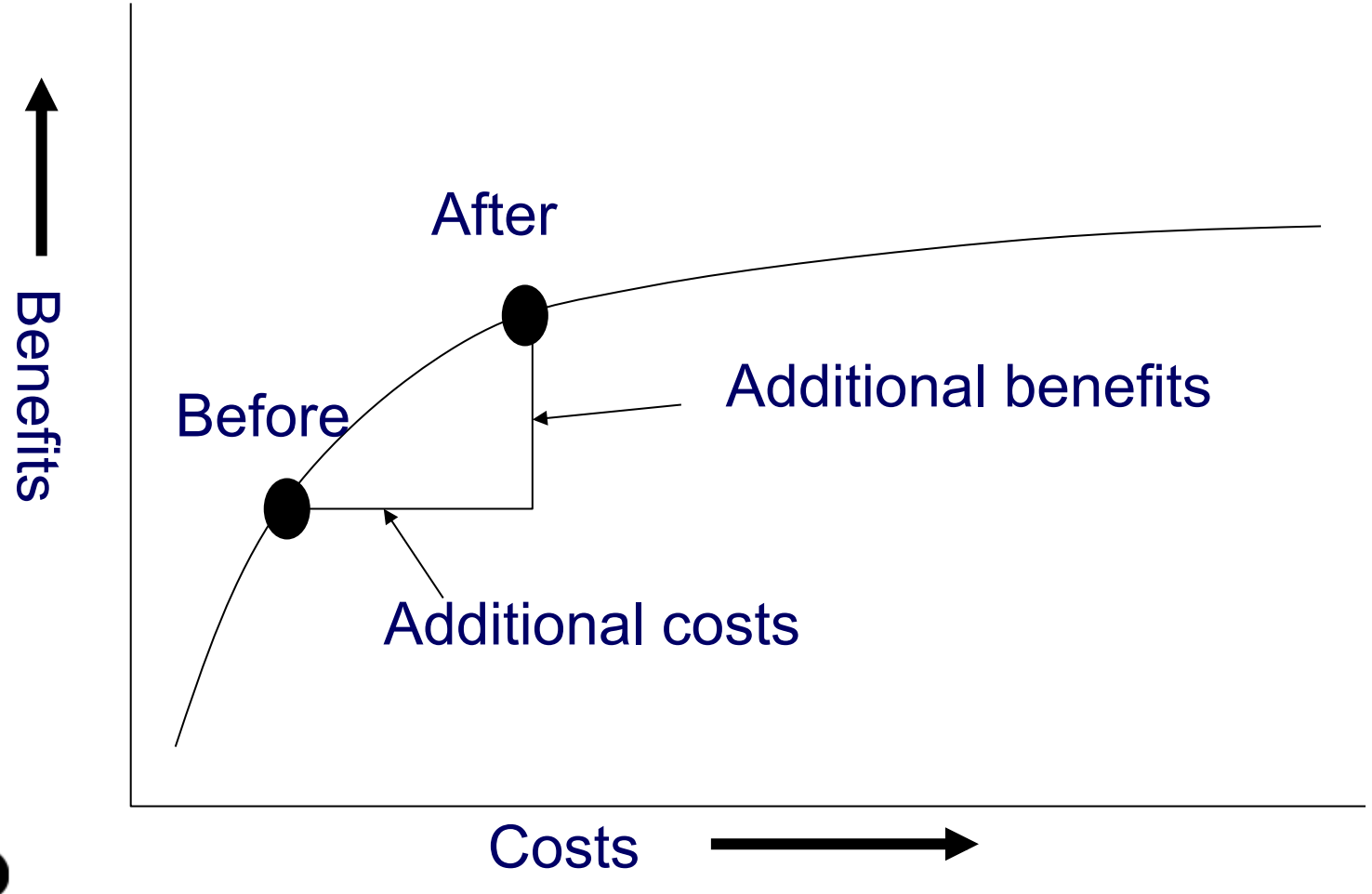
Additional costs and benefits of an animal health intervention



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Partial budget analysis is interested in four basic items:

Additional Costs	Additional Benefits
a) New costs	c) Costs saved
b) Lost revenue	d) New revenue

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Assessing change over time

- If a change has an impact over a number of years the analysis become slightly more complicated
- There is a need to understand the time value of money and to use discounting in order to compare costs and benefits in different years
- The underlying framework does not change – a cost benefit analysis still compares the additional costs and additional benefits of a change

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Costs

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Cost analysis

- Costs need to be split between
  - Capital or fixed costs
  - Recurrent or variable costs
- The cost analysis where possible should be thorough in terms of time, logistics and resources used
- It is rare that we see this in an animal health context and human health has better examples

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Benefits

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Estimating Benefits

- Benefit streams for investments in the future are **predictive** – not definitive!
- For animal health decisions benefit streams are based on:
  - Epidemiological models
  - Market models
- The market models are dependent on the epidemiological model – both types of models contain levels of uncertainty

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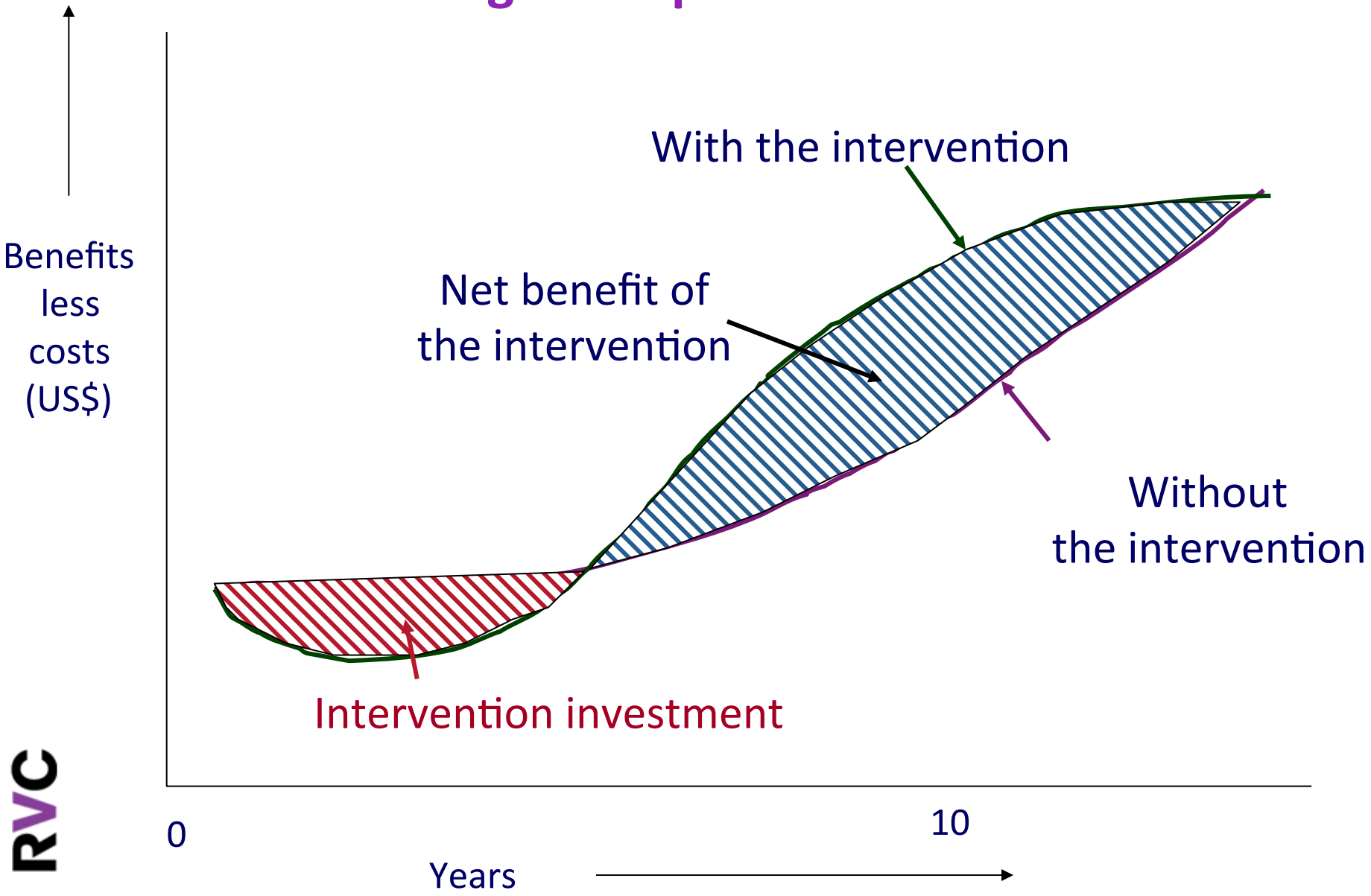
The estimated benefits of an intervention with an investment using a complex base line estimate



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Which method to assess change?

- Conventionally animal health has used **cost-benefit analysis** as the method for assessing change
- Human health has much more experience and willingness to use **cost-effectiveness analysis** (Drummond et al, 2005)
- Presenting levels of uncertainty generated from the models used by either method can in turn create uncertainty of the decision maker

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Cost Benefit Analysis

- Same underlying principle, **the comparison** of **additional costs** with **additional benefits**
- Yet these additional costs and benefits occur in **different years** (time periods) and need to be converted to **present values**
- It generates three metrics net present value (**NPV)**, benefit cost ratio (**BCR**) and internal rate of return (**IRR**) which provide an indication of **economic profitability**

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Which discount rate?

- A discount rate measures the rate at which one is willing to trade present for future consumption
- For public projects two different measures (Lopez, 2008) can be used:
  - Social opportunity cost of capital
  - Social time preference
- Animal health decisions create an interesting dilemma between a productive industry and the wellbeing of society – the choice is dependent on the type of diseases

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Metrics

- **Net Present Value** – the difference between the benefits and costs in present values
- **Benefit-Cost Ratio** – the ratio between the benefits and costs
- **Internal Rate of Return** – the discount rate at which NPV = 0 and BCR = 1

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Cost benefit analysis

- A cost benefit analysis estimates the **economic profitability** of a change
- Before proceeding with an investment there is a need to carry out a **financial feasibility** which takes into account the actual cash flow and the source of the money for the investment

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Assessing economic benefits of farm level control

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Farm-level economic impact assessment for FMD and its control

- The **majority of FMD economic impact** studies focus on the economic losses at the **national level**
- While this is valid in **making decisions** on **public expenditure** for disease control and eradication programmes it usually **ignores** the **incentives** at **farm-level** to control the disease.
- **Extensive systems** suffer **low levels of loss** and **risk** due to FMD and therefore farmers with these types of system may not be very interested in participating in control campaigns without additional incentives.

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Assessing FMD control in extensive Bolivian beef systems

- A herd model was developed which allows changes in mortality, fertility and offtake rates and prices
- The model estimates a herd without vaccination and another for a herd with vaccination
- FMD is introduced as an outbreak in the first year

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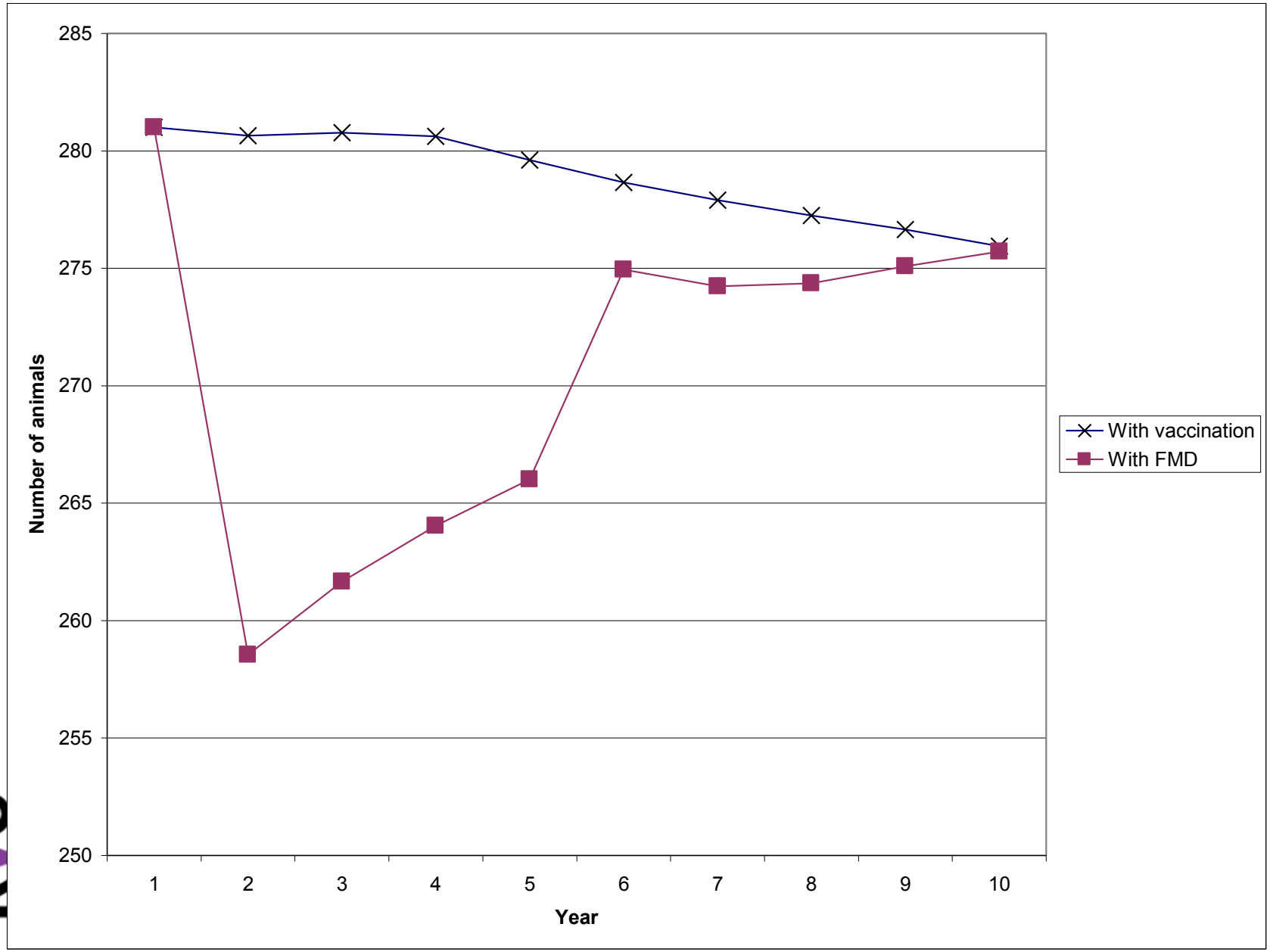
Projections for herds with vaccination against FMD (i.e. no disease) and a herd without vaccination and an outbreak of FMD in the first year of the simulation



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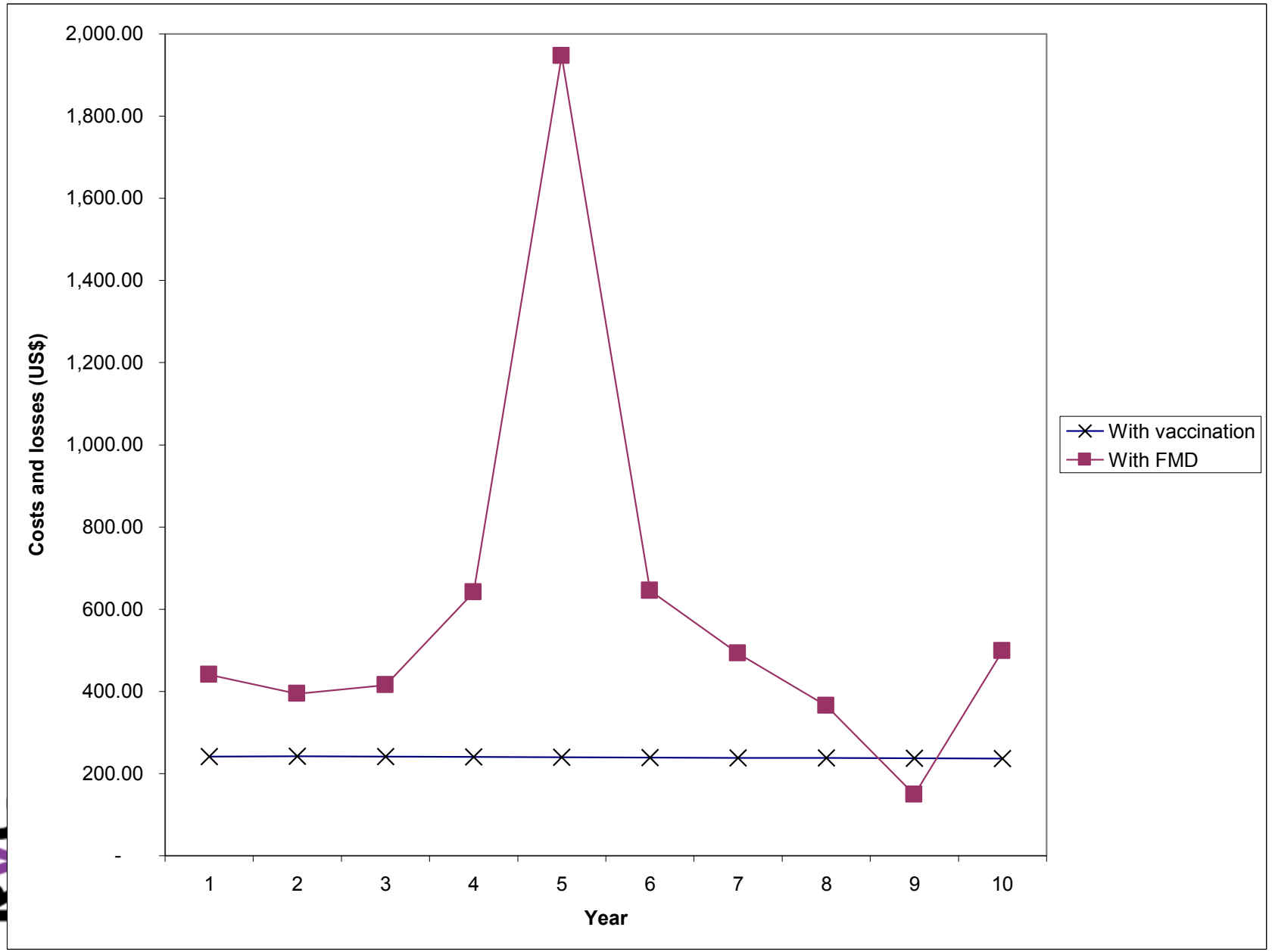
Undiscounted costs and disease losses for a herd with vaccination and a herd without vaccination and an outbreak of FMD in the first year of the simulation (US$)



FMD control in extensive beef systems- the case of Bolivia

- Losses are predicted to occur so long after the outbreak
- In these extensive systems male animals are sold at between 4 to 6 years of age and female animals are normally all retained in the herd
- An FMD outbreak in such a system has little effect on the male adult animals, but increases calf mortality and reduces fertility in cows and heifers

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FMD control in extensive beef systems- the case of Bolivia

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FMD control in extensive beef systems- the case of Bolivia

- Losses are predicted to occur so long after the outbreak

Extensive cattle farmers need targeted policies to vaccinate against FMD

- An FMD outbreak in such a system has little effect on the male adult animals, but increases calf mortality and reduces fertility in cows and heifers

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What is missing?

- There is a tendency to forget that critical parameters within the analysis will have variation
- These create degrees of uncertainty that can be quantified with an economic risk analysis
  - Commonly used tool would be decision tree analysis
- Some of these variations will also surround the prices of resources and valuation becomes critical to make sensible assessments

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Risk and uncertainty

- Where a decision is uncertain people will be interested in the range of the outcomes as well as the average
- Many people will reject large ranges and some will want a decision that guarantees a minimum return
- Most will not want a disaster outcome
- Vaccines and vaccinations cannot afford to generate additional risks

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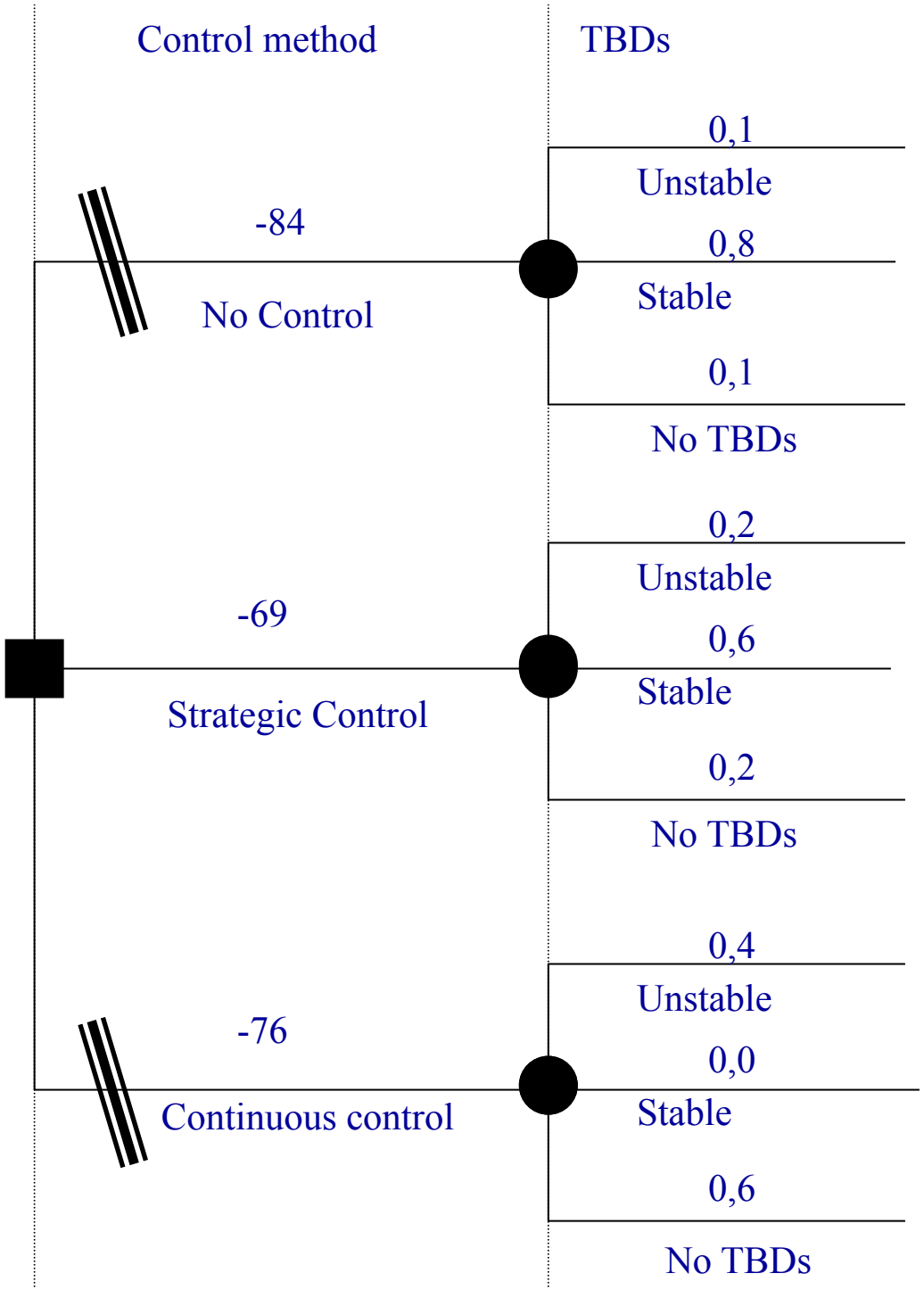

Total	Disease losses	Control costs
-120	-120	0
-90	-90	0
0	0	0
-90	-60	-30
-75	-45	-30
-30	0	-30
-100	-40	-60
-90	-30	-60
-60	0	-60

	PROGRAMME								
	No control			Strategic Control			Continuous control		
	$	P	$ * P	$	P	$ * P	$	P	$ * P
Unstable	-120	0.1	-12	-90	0.2	-18	-100	0.4	-40
Stable	-90	0.8	-72	-75	0.6	-45	-90	0	0
No TBDs	0	0.1	0	-30	0.2	-6	-60	0.6	-36
Expected Value	**-84**			**-69**			**-76**		

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Compensation

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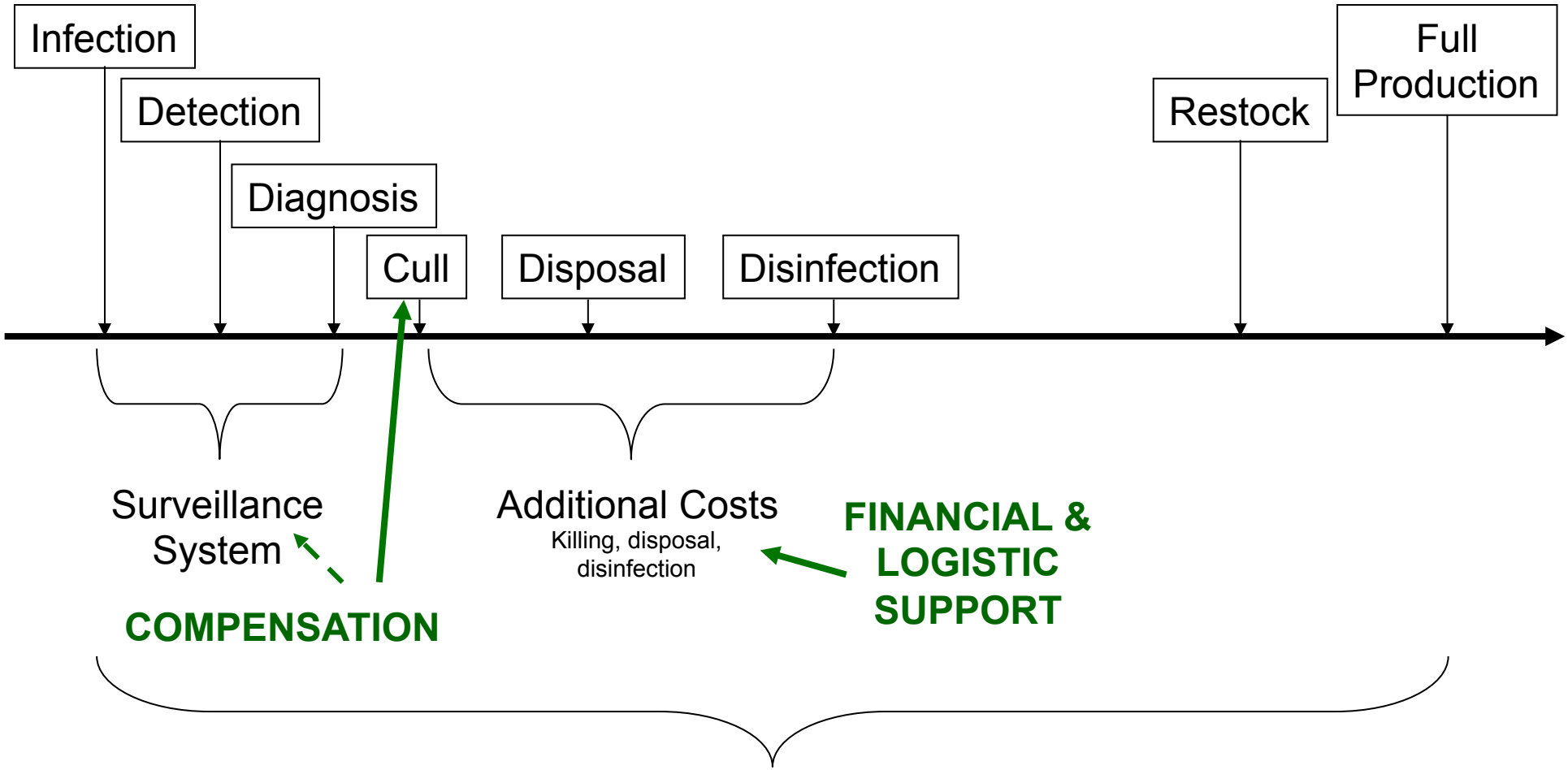
Stamping out process

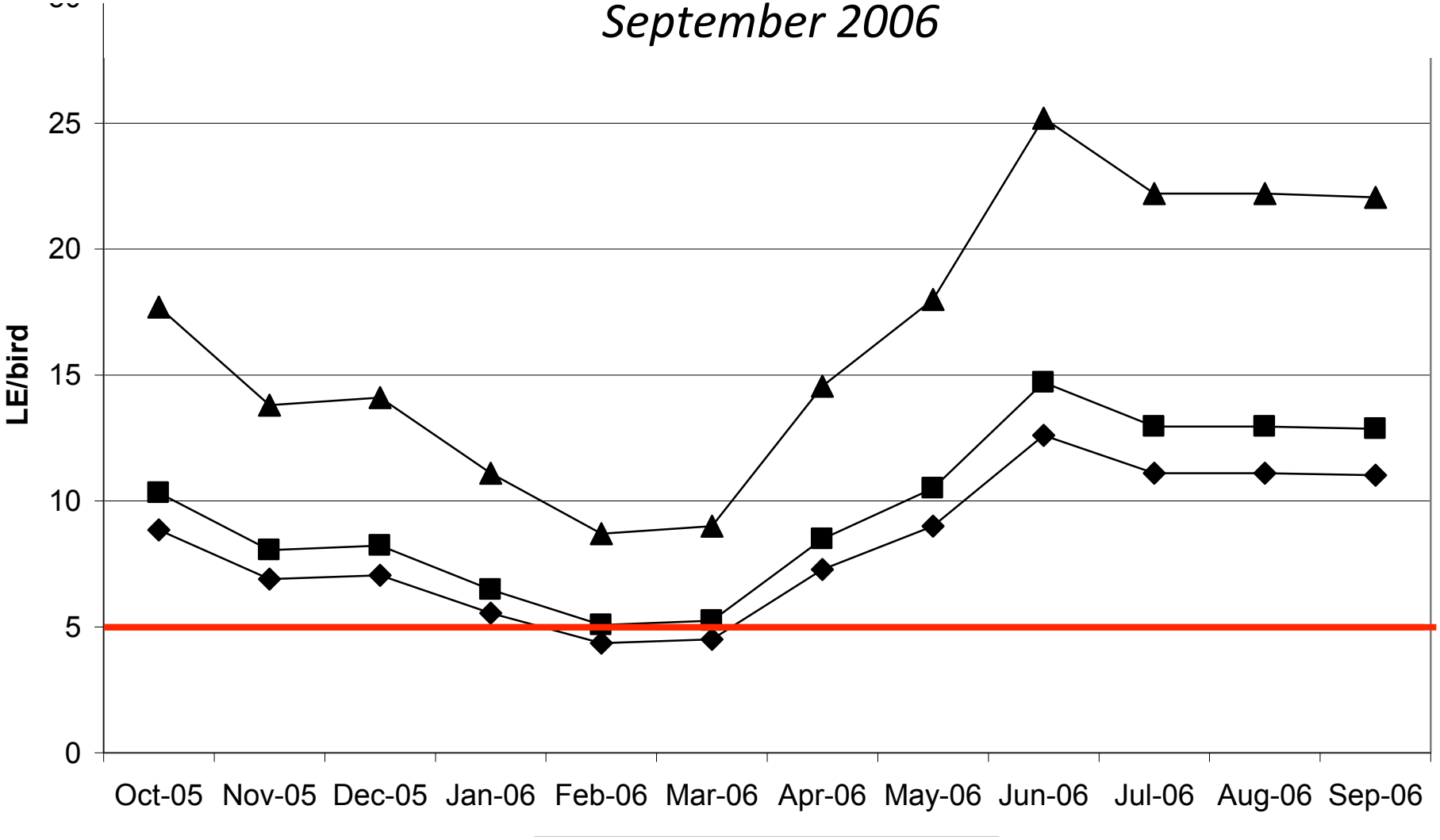


- Commercial Sector Fixed Costs – commercial loans
- Other sectors – informal loans and micro-credit
- Backyard sector - lack of income and sources of protein for home consumption
- Consumers – a lack of affordable protein

REHABILITATION

Setting compensation rate

Estimated finished broiler price (LE/bird) October 2005 to September 2006



Impact of HPAI and its control supported by compensation

Species or bird type	Population 2005 ('000)	Estimated Official Cull	
		Number ('000)	As % of 2005 Population
Broiler grandparent	240	48	20.0
Broiler breeder	8,000	1,113	13.9
Fattener commercial	116,667	8,177	7.0
Fattener local	3,750	495	13.2
Layer Breeder	960	960	100.0
Layer	22,000	17,736	80.6
Urban smallscale	6,720	??	??
Rural smallscale	44,960	??	??
Ducks	8,000	421	5.3
Turkeys	3,000	60	2.0
Pigeons	4,000	??	??

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Summary

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Importance of economic assessments of interventions

- Provide information on the additional financial costs of a change
- Gives an indication of the economic profitability of the change
- Indicates whether there is uncertainty with the change and ideally quantifies the risk
- It is a basis for informed decision making

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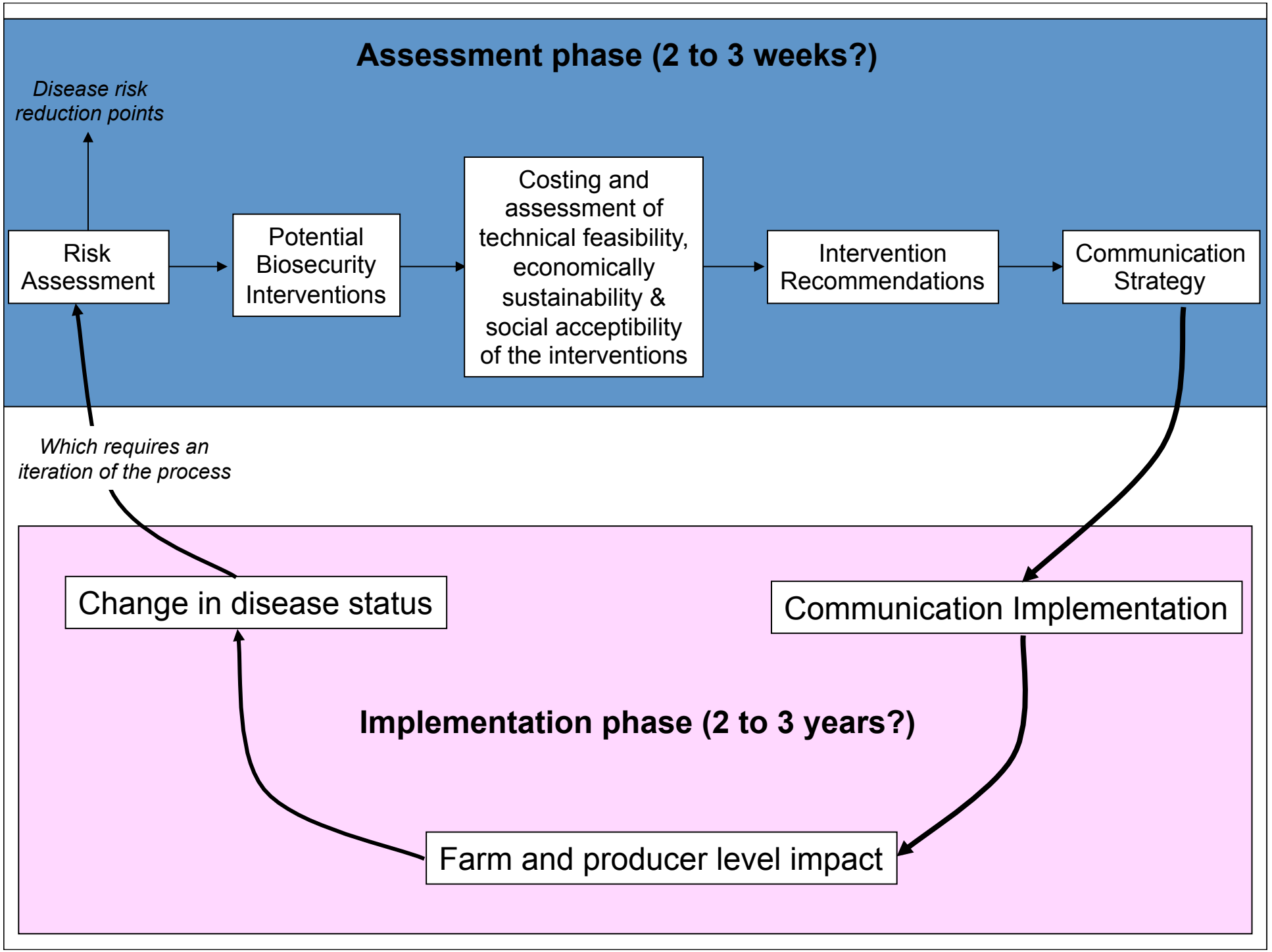
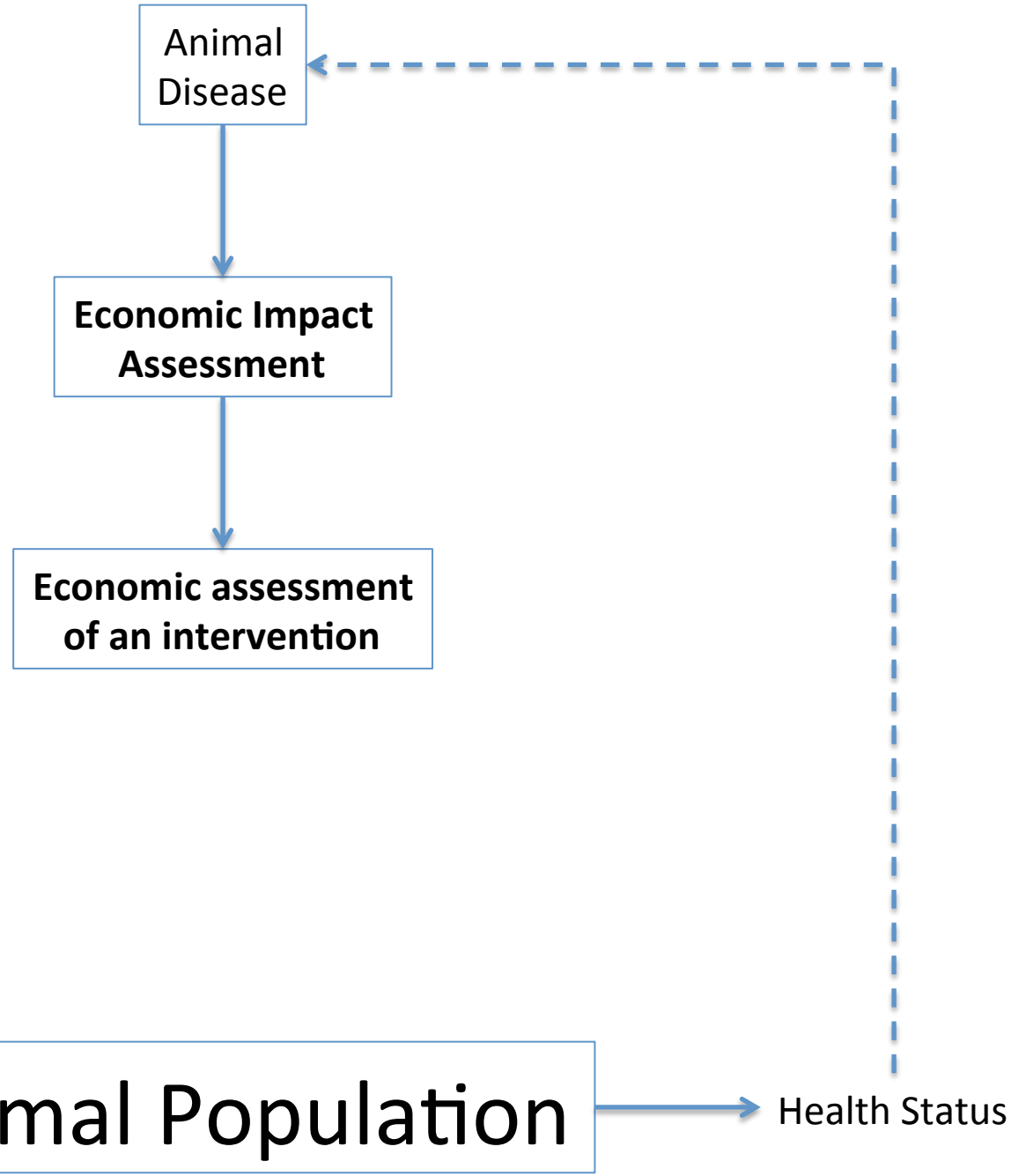

Assessment phase (2 to 3 weeks?)
Disease risk reduction points
Risk Assessment
Potential Biosecurity Interventions
Costing and assessment of technical feasibility, economically sustainability & social acceptibility of the interventions
Intervention Recommendations
Communication Strategy
Which requires an iteration of the process
Change in disease status
Communication Implementation
Implementation phase (2 to 3 years?)
Farm and producer level impact

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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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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