

Economic aspects related to tail biting and tail docking

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Natural Resources Institute Finland (Luke)

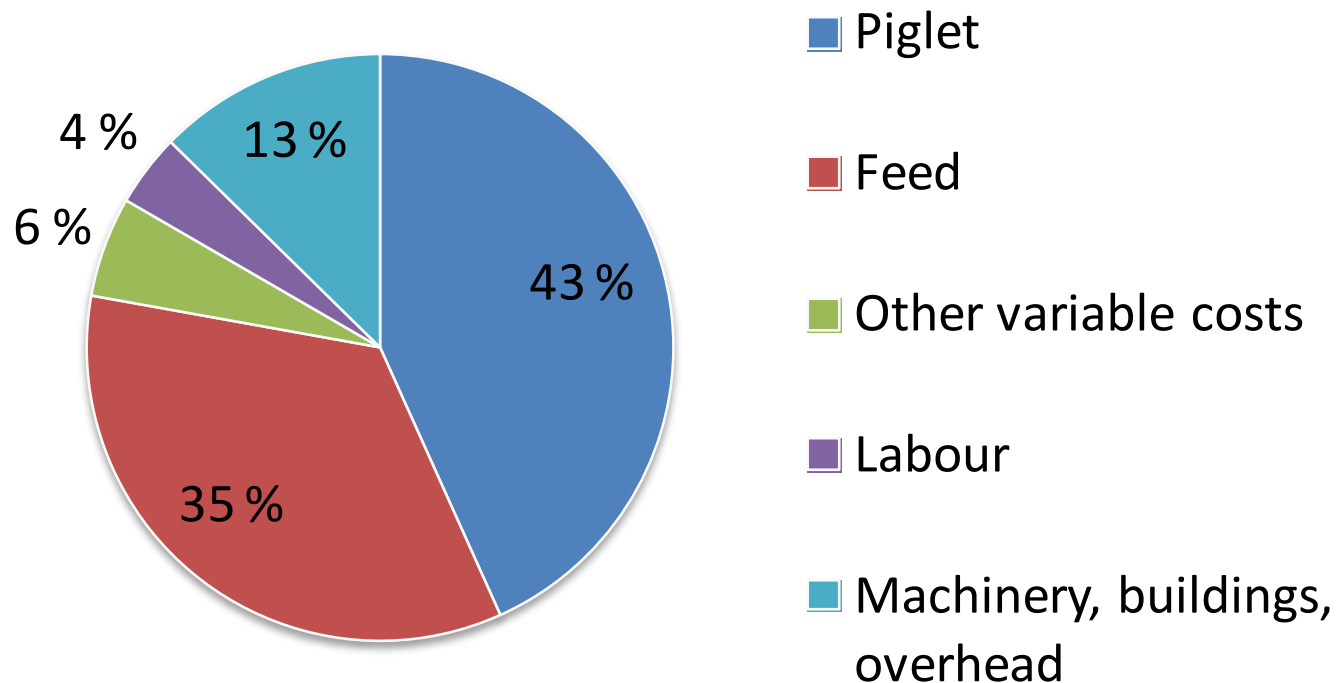
- Luke is a research and expert organisation
- We promote bioeconomy and sustainable use of natural resources.
- Four research units, a statistics unit and an internal services unit
- The number of staff is about 1500 persons
- Competencies are exploited in multi-disciplinary research programmes and projects carried out in collaboration with Finnish and international partners.
- Our customers, the end users of the information and solutions we offer, play a major role in planning and determining the focus of our research activities.

Outline

- Overview of economy of pig farms in Finland
- The costs of tail biting
- Studies related to economic aspects of tail biting and tail docking



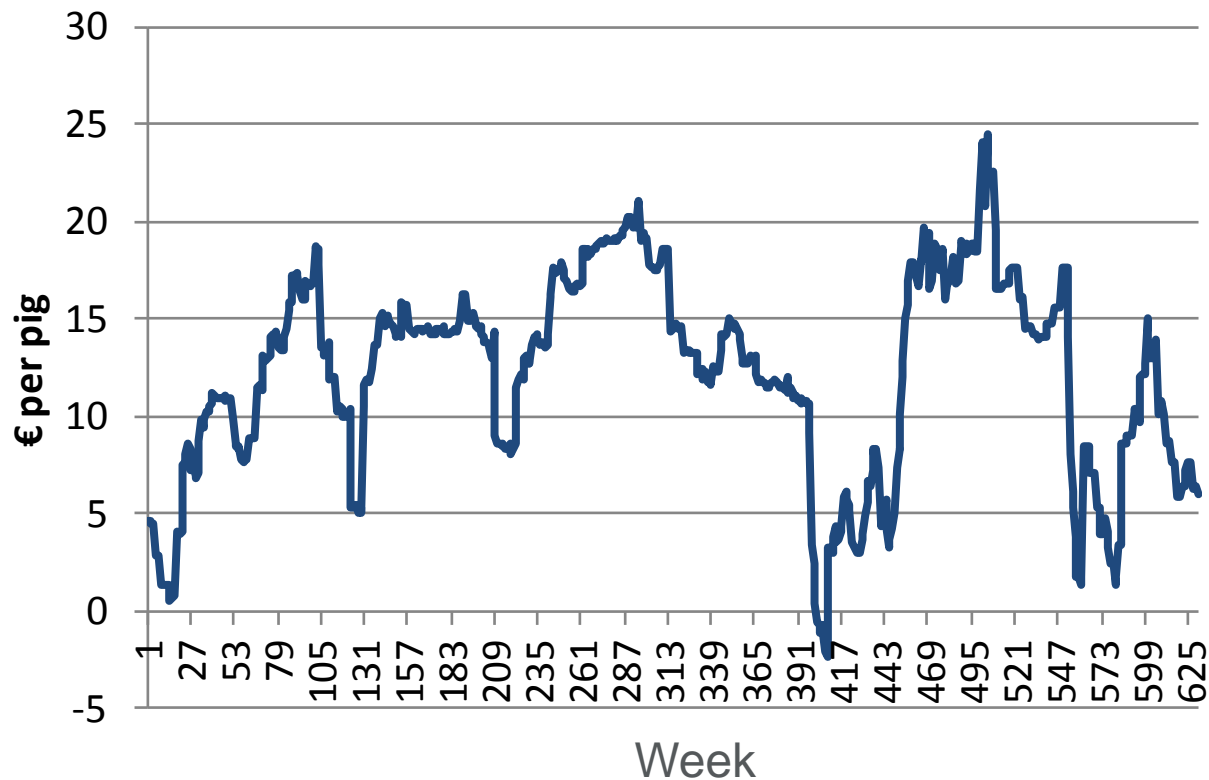
Cost structure of pig production in Finland in 2014



Estimated production cost was 1.73 €/kg

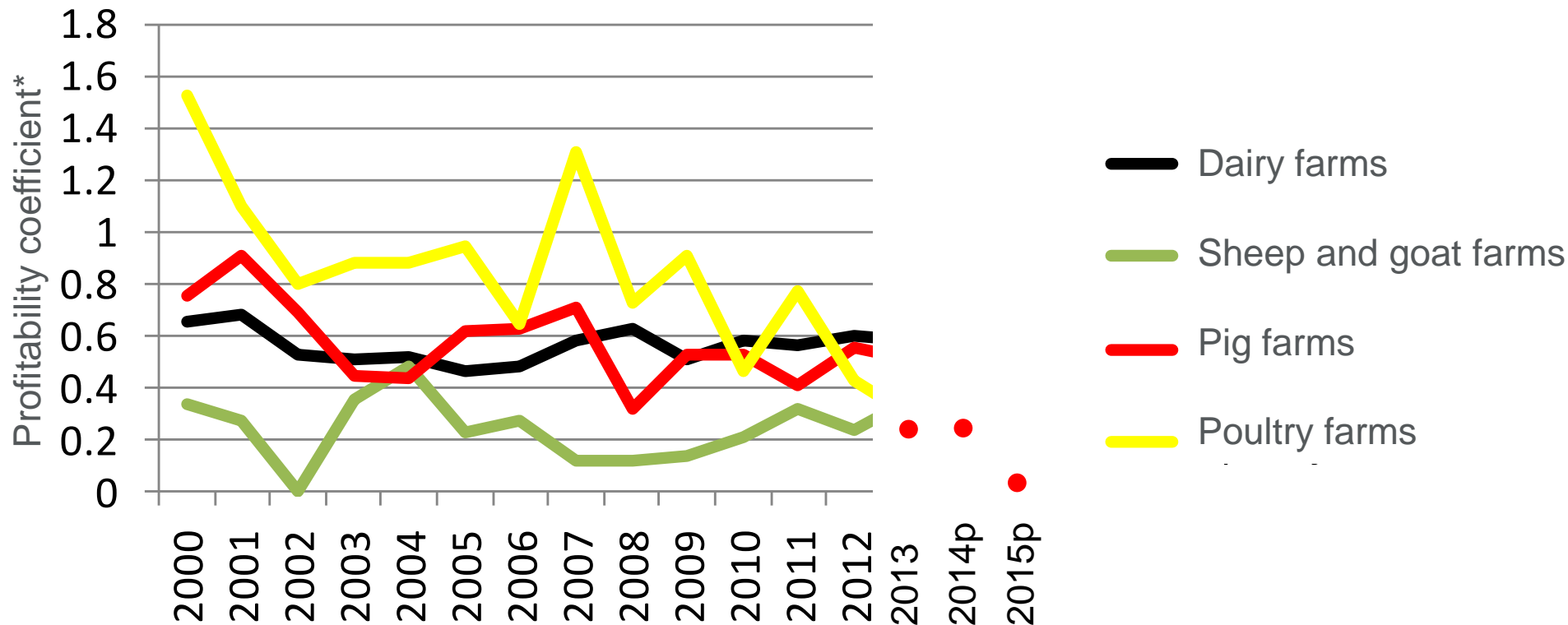
Source: ProAgria

Standardized margin revenues - variable costs in pig fattening (weeks 1/2000-4/2012)



Profitability of livestock farms by production line

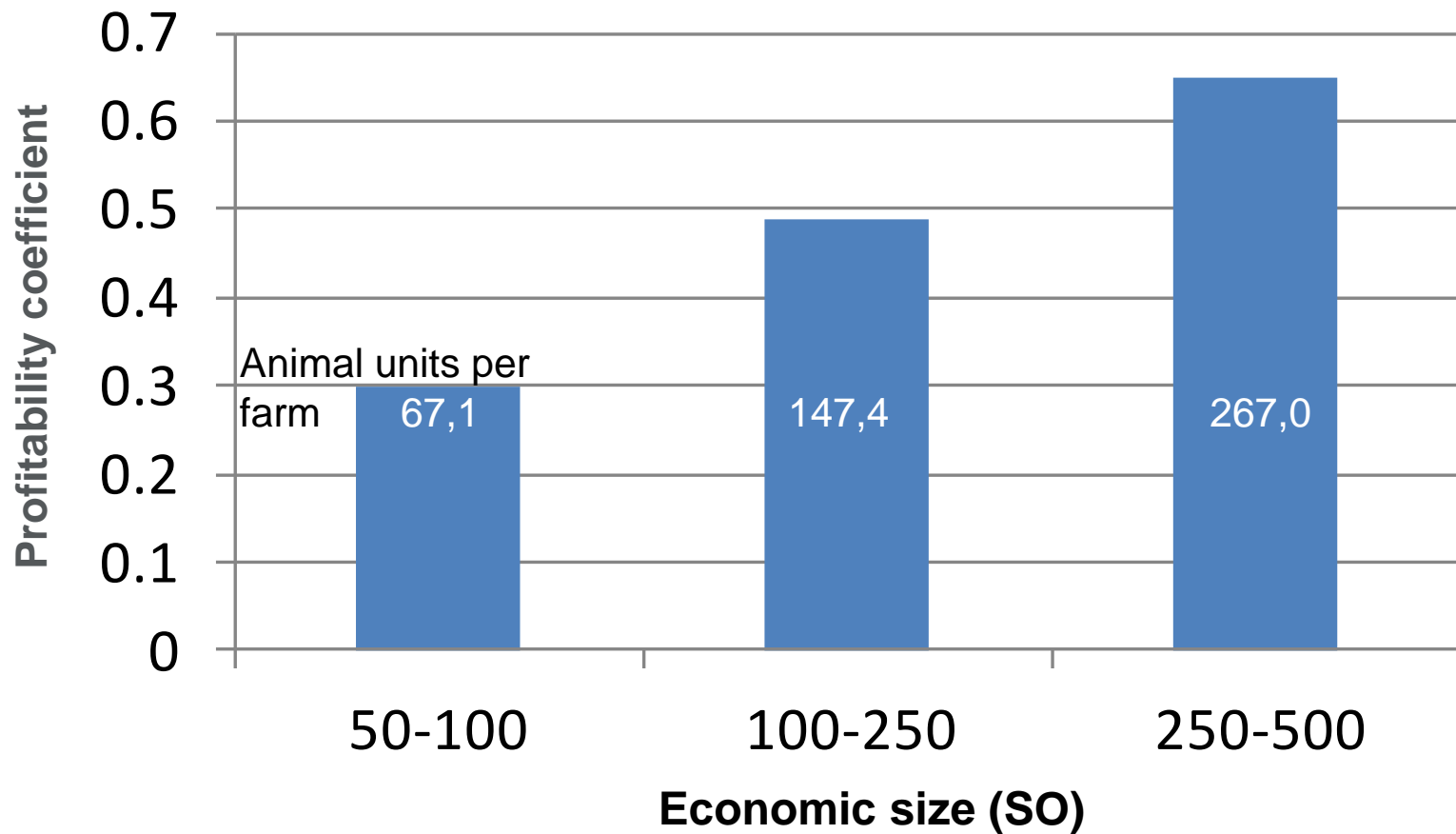
Source: Luke Economy doctor



Profitability coefficient = realised entrepreneurial income divided by requested entrepreneurial income

Profitability coefficient by farm size in 2012

(Luke economydoctor)



Schemes related to animal welfare

Farm animal welfare support 2015-16

- Commitment to the compensation scheme is made annually
- Three measures are relevant to control tail biting:
 - Feeding and treatment of pigs (€7 animal unit*) – requires written plans on **feeding**, production "management" and what will be done in the case of malfunctions (**e.g. disruptions in feeding, ventilation or water supply**)
 - Providing lying box with litter to weaned piglets and fattening pigs (€59 per animal unit*)
 - Providing enrichments to the pigs (€13 per animal unit*) – must provide both fixed enrichments (e.g. toys) and enrichments which are replenished daily
- One fattening pig is equal to 0.3 animal units

Slaughterhouse quality assurance schemes

- All major slaughterhouses (HKscan, Atria, Snellman) have a quality assurance scheme providing guidelines on how to produce (housing, animal health, feeding, management, genetics etc.)
- Pig producers are expected to comply with these guidelines
- Regarding animal health, the schemes are currently linked to "Laatuvastuu" and "Sikava"
 - One of the criteria in Laatuvastuu is that tails are not docked, which is verified by vet's scheduled farm visits
- Farms complying with the schemes are entitled to a price premium which varies by company and sometimes by the level of compliance
- Price discounts are applied should carcass condemnations occur, but they vary by slaughterhouse

How consumers view pig production?

Some consumers are willing to pay for improved animal welfare

- International meta-analysis suggests that the consumers are willing to pay (WTP) on average about 14% price premium for animal welfare, although WTP varies by country, definition, product etc. (Lagerkvist & Hess 2010, Cicia & Colantuoni 2010).
- In Finland, some 54% of respondents were willing to pay an extra price premium for increased welfare in pigs (Forsman-Hugg et al. 2009)
- In another survey (Penttilä et al. 2012)...
 - Animal welfare above the legal minimum was ranked as the second most important (after product safety) dimension of responsible pig production, with 91% of respondents considering it either very important, important or quite important
 - 62% of respondents agreed (6% disagreed) that s/he buys finnish pigmeat because animal welfare has been taken into account better in Finnish than in non-Finnish production

How Finnish producers view animal welfare?

Livestock producers have different views

(Kauppinen et al. 2012)



- The livestock producers' intentions to improve animal welfare were best explained by their attitudes towards the specific welfare-improving actions
- Providing the animals with a favourable living environment and healthcare were the most often mentioned ways to improve animal welfare.
- Often farmers perceived the actions to improve animal welfare as important but difficult to carry out
- Impact on producers' own wellbeing (including economic and other wellbeing) is an important factor in improving animal welfare
- Altruistic and utilitarian persons

Producers views regarding animal welfare support scheme in 2007–2013 (Koikkalainen et al. 2015)

- The most common stated reason why a producer committed to the scheme was that they wanted to improve
 - a) animal welfare
 - b) economic result of their farm
- Improvements in the of the lying boxes was mentioned the most frequently as a practical measure related to the scheme
- About 50% of producers felt that animal health had been improved because of the scheme
- Effects on animal behaviour were also seen



The costs of tail biting

Please note that economic estimates presented in different slides are not always comparable as they may represent different cases

Tail biting is a multifactorial problem which risk factors include...

- Victims and/or biters are not removed from the pen
- Inadequate or lacking enrichments
- Inappropriate temperature
- Lack of straw
- Gender
- Too low space allowance, group size
- Competition on feed, water etc.
- Poor health status
- Mixing of animals
- Distortions in ventilation, feed or water supply
- Other factors
- See more on a literature review in the next slide

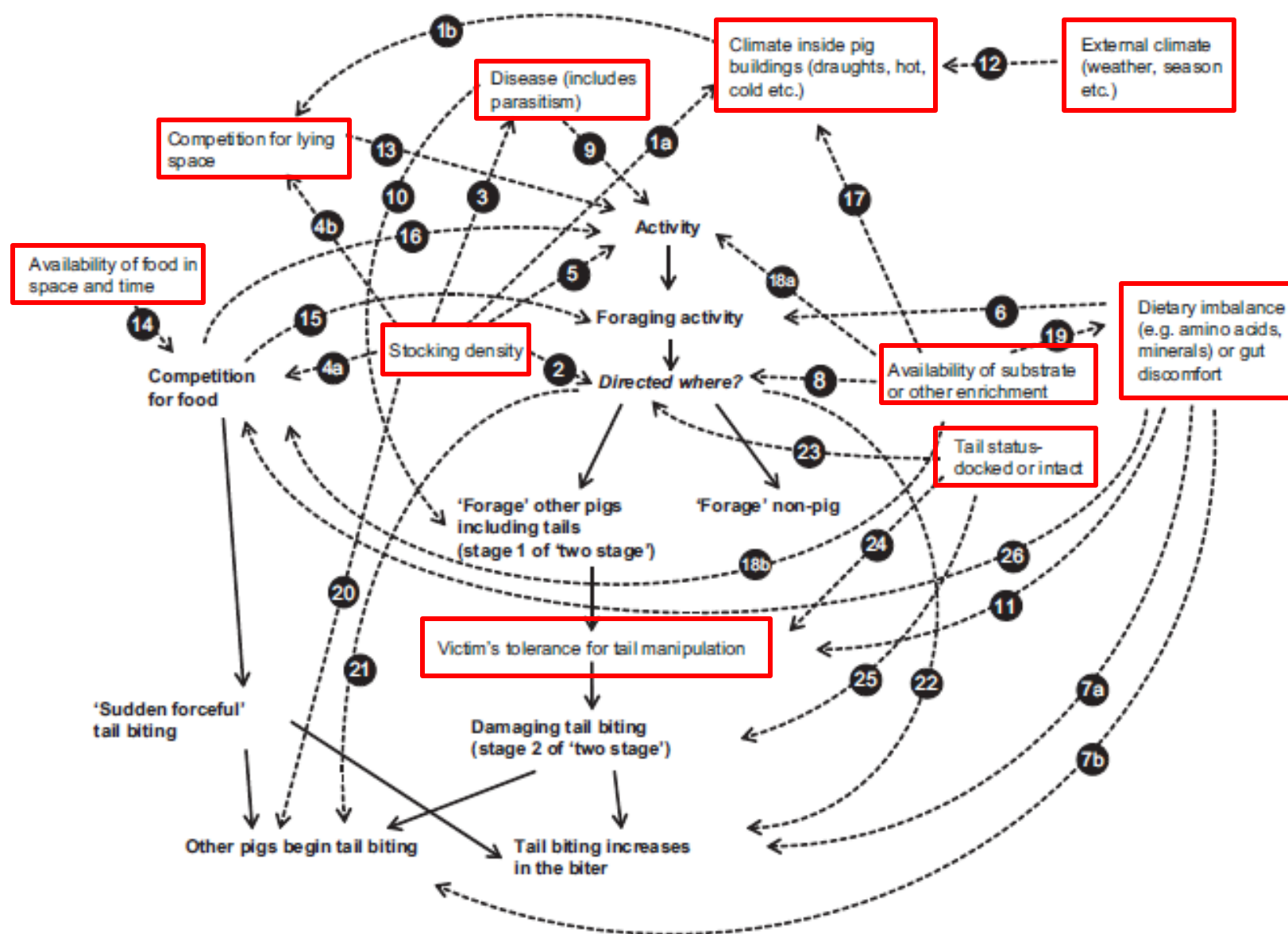


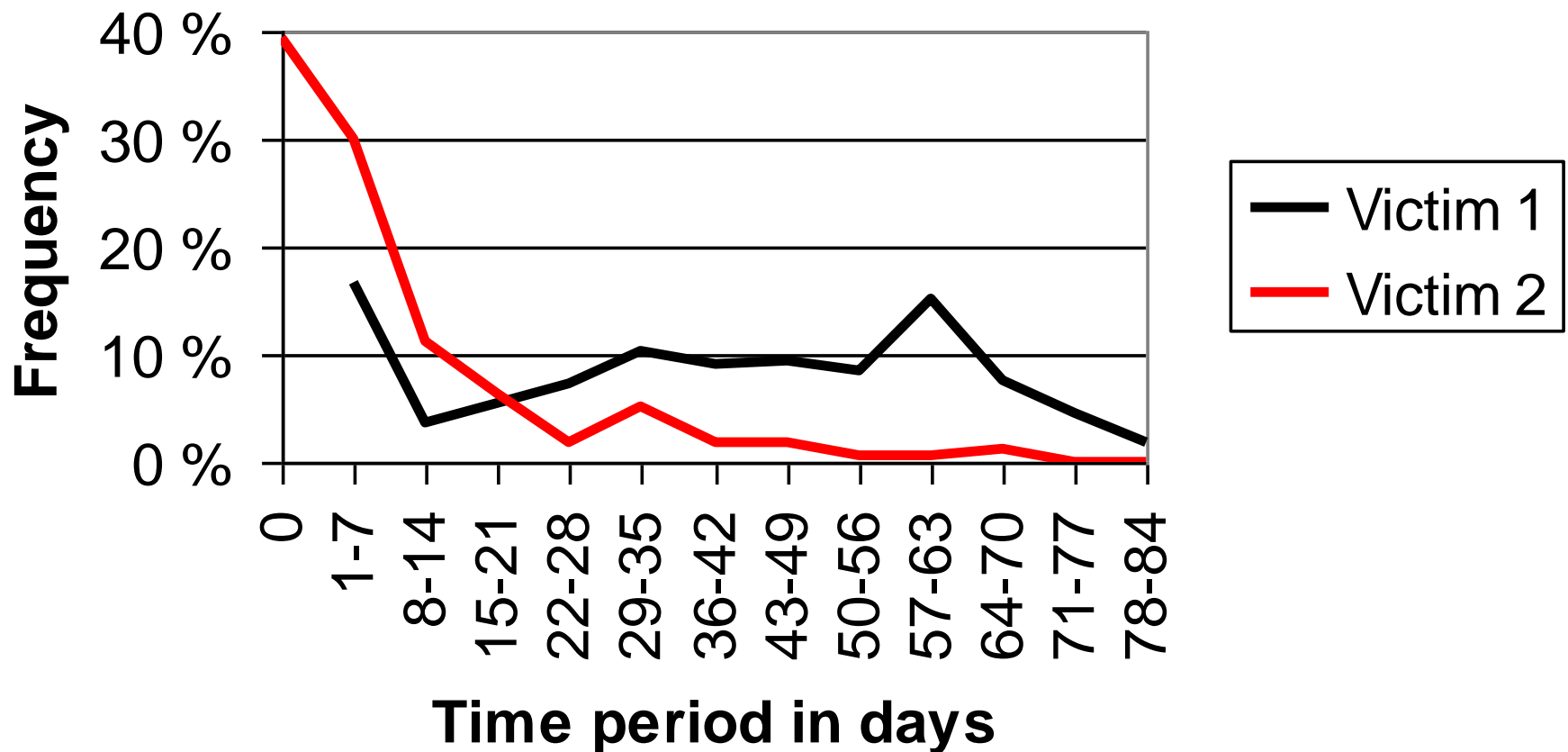
Figure 1 Postulated relationships between the underlying processes of tail biting (text in bold, connected in order by solid arrows) and various known or suspected risk factors (text in plain type) connected with dashed numbered arrows to show how some of the risk factors might influence each other or the underlying process of tail biting. Some proposed risk factors for which the evidence is currently weak (e.g. disease and parasitism, draughts) are included where a plausible hypothesis exists. The meaning of the numbered arrows is explained in Supplementary Material S1.

Costs of tail biting

- Reduced growth
- Increased feed consumption
- Increased mortality
- Extra labour needed
- Less efficiently used pen space
- Increased veterinary treatment costs
- Carcass condemnations
- Preventive measures

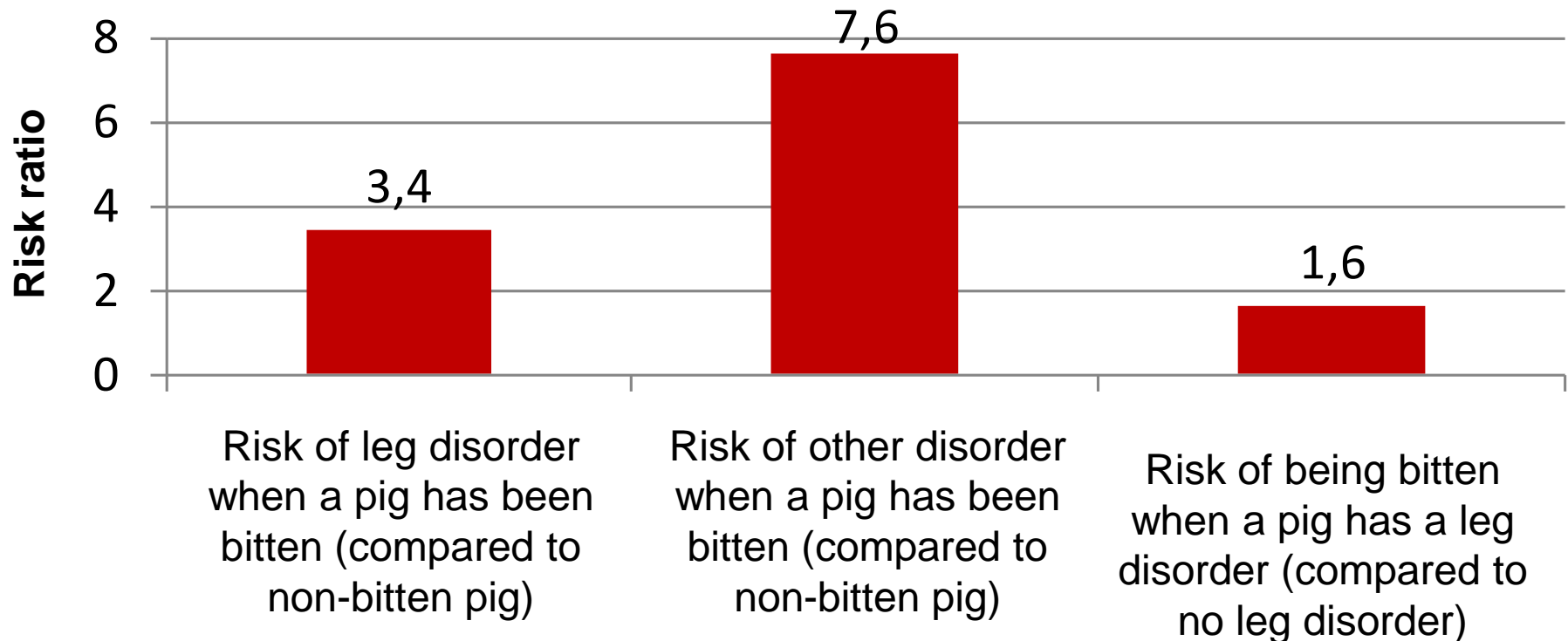
Tail biting can occur like an epidemic

The following slides are based on a Nordic study "Tail biting and tail docking: Biology, welfare, economics".

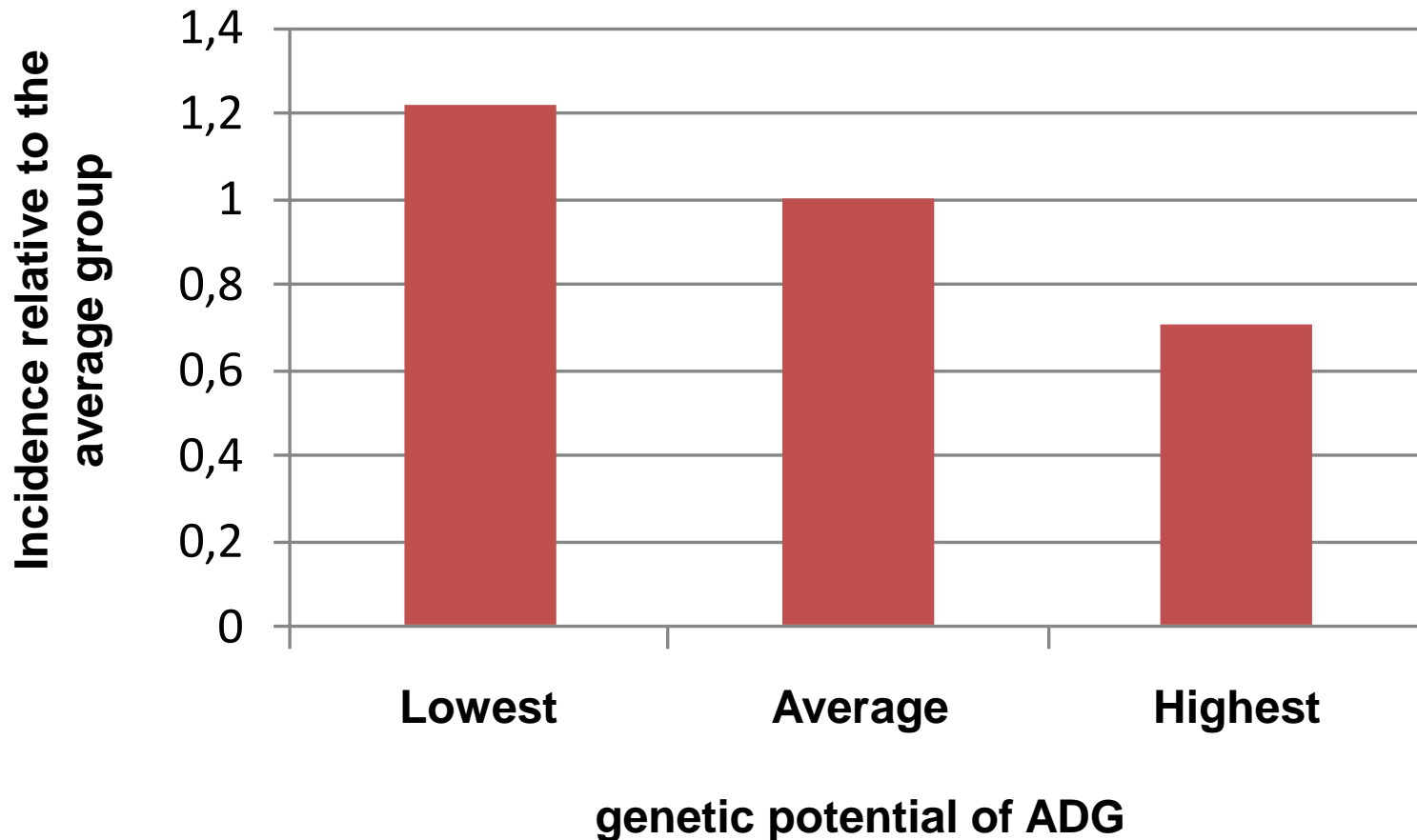


(Days after arriving at the farm or days after the first case)

Besides TB, bitten pigs have more other disorders



Pigs having poor genetic potential are bitten more frequently



Each group covers about 1/3 of pigs
N=1236-1281 pigs per group

Impact of TB on average daily gain (g/d)

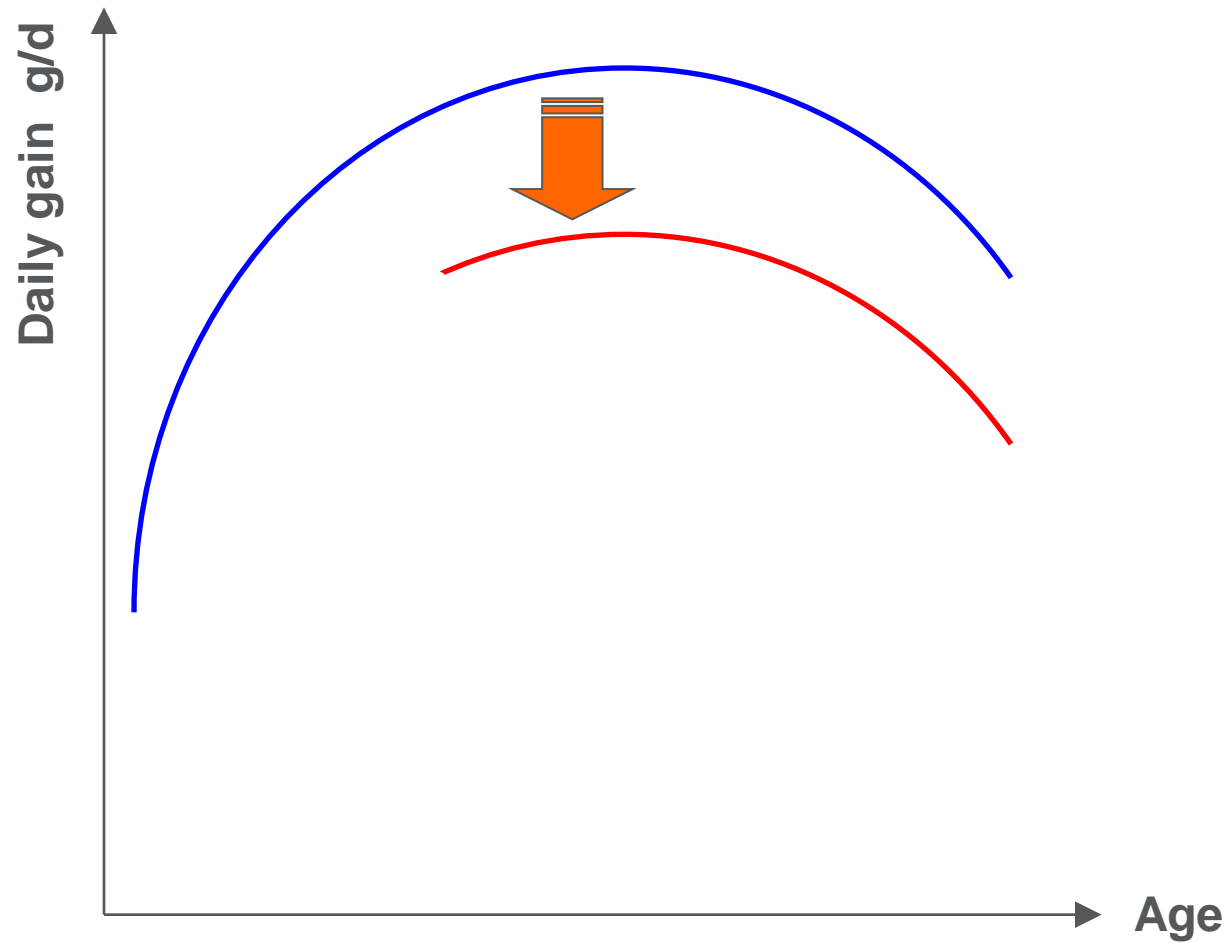
- Castrated pigs have the largest difference in median ADG between victims and non-victims

Sex	Phenotypic difference ¹	Genetic difference ¹
Boars	11.0 n.s.	9.8 *
Female pigs	38.0 ***	15.0 ***
Castrated pigs	63.5 ***	19.4 ***
All	29.5 ***	13.8 ***

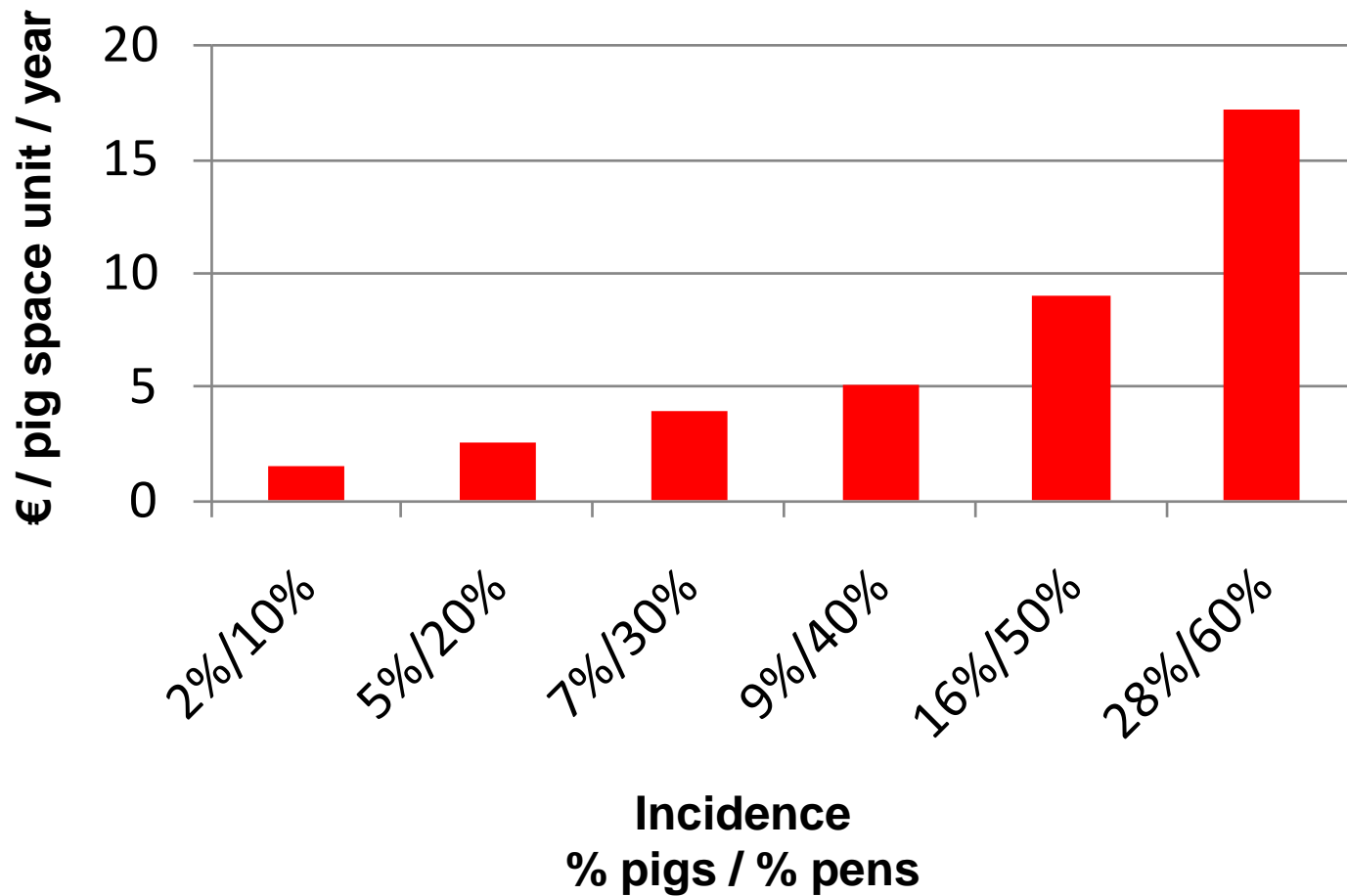
¹ Significance levels (Mann-Whitney U-test), *=P<0.05; ***=P<0.001; n.s.=not significant. Measurements excluding pigs eliminated from the experiment.

Source: Sinisalo et al. 2012

Impact of TB on growth



The cost of tail biting by incidence



Costs of tail biting

- Economic loss due to tail biting are likely to range from €10 to €40 per bitten pig
 - These costs are mainly due to extra work, materials and medication and carcass price discounts
 - Reduced ADG and FCR and the value of condemned meat may present just 10-15% of losses
- For instance in a finishing farm having 1000 fattening pigs the costs can be several thousands of euros per year
- Extra work is need to control for the problem. This may reduce probitability but simultaneously it can increase entrepreneur's income

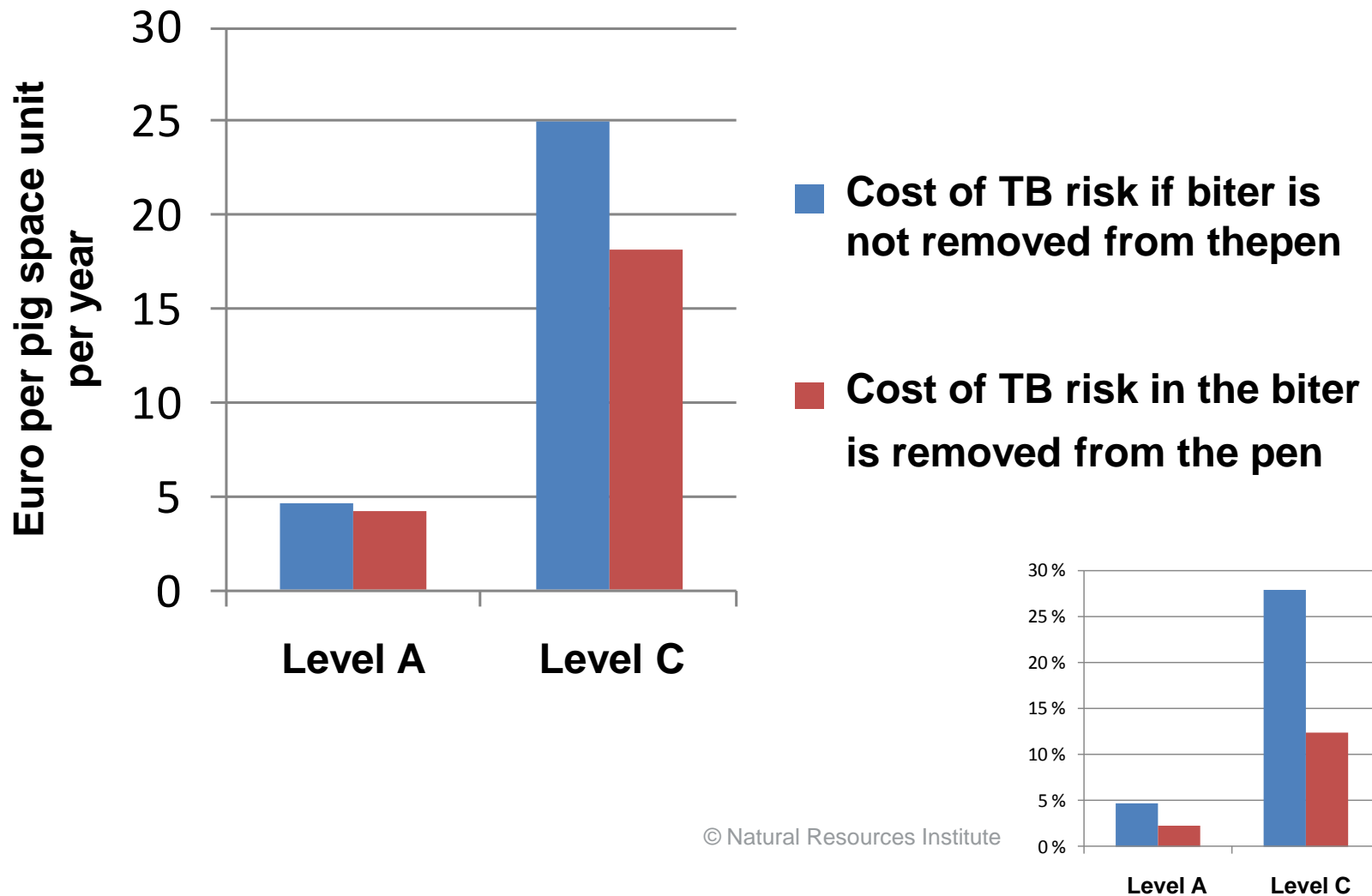
Medication costs per bitten pig

- Duration typically 3-5
 - The costs of medicine and vet depend on how the farm and the veterinarian are operating
- Extra work due to medications
- At least some bitten pigs and biters would be moved to a hospital pen
- Estimated cost of taking care of the victim was 10.4 €/bitten pig

Carcass condemnations

- Pigs having a tail damage tend to have more carcass condemnation than non-bitten pigs
 - The effect can vary from zero up to several percents
- In a median case partial carcass condemnations were 3,8 kg/carcass, part of which was likely due to tail biting (Valros et al. 2004)
- Some slaughterhouses apply price discount for a carcass which has been bitten.
 - Although the amount of condemned meat itself can be of minor importance, the loss due to price discount can be substantial!

Estimated effect of removing the biter



Cost of enrichment materials

(Telkänranta et al. 2014)

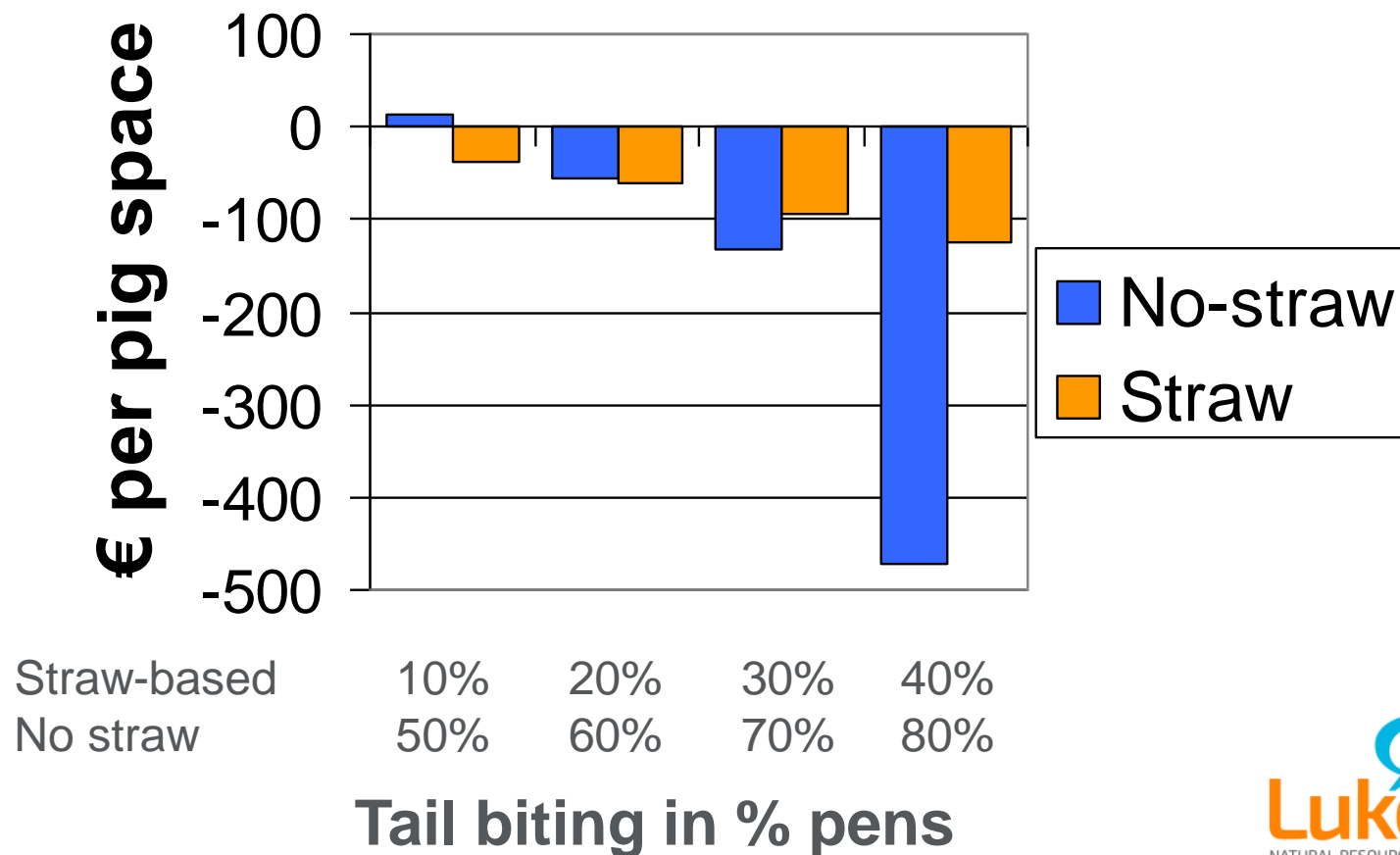
- Rope and newspapers: material and labour costs were €133 (217 pigs)
 - It helped to “save” 49 victims, increased productivity by €119
 - Net cost 11 cents per pig (29 cents per saved tail)
- Fresh wood: material and labour costs were €270 € (152 pigs)
 - It helped to save 36 victims, increased productivity by €230
 - Net cost 26 cents per pig (€1.11 per saved tail)

Costs of housing

- Mäki-Mattila (1998):
 - Production costs per kg pigmeat were 3 to 5% higher in a deep-bedding (no slatted floor, wood-based material as bedding) system than in a liquid manure/partly slatted flooring system
 - Production costs per kg pigmeat were 7 to 8% higher in a dry manure than in a liquid manure system
 - The difference was mainly due to labour and fixed costs
- In general, our studies show
 - The use of small amount of straw, if effective, is also cost effective.
 - Routine (daily) use of any measure can be profitable only if it is effective in reducing TB and the cost of measure per day are minimal
 - Heavier measures are profitable in cases where TB becomes a major problem.

Housing

Return per pig space unit at different levels of tail biting risk (% pens suffering from TB) with straw-based and non-straw (or minimal straw) housing when compared to straw-based pen with no tail biting

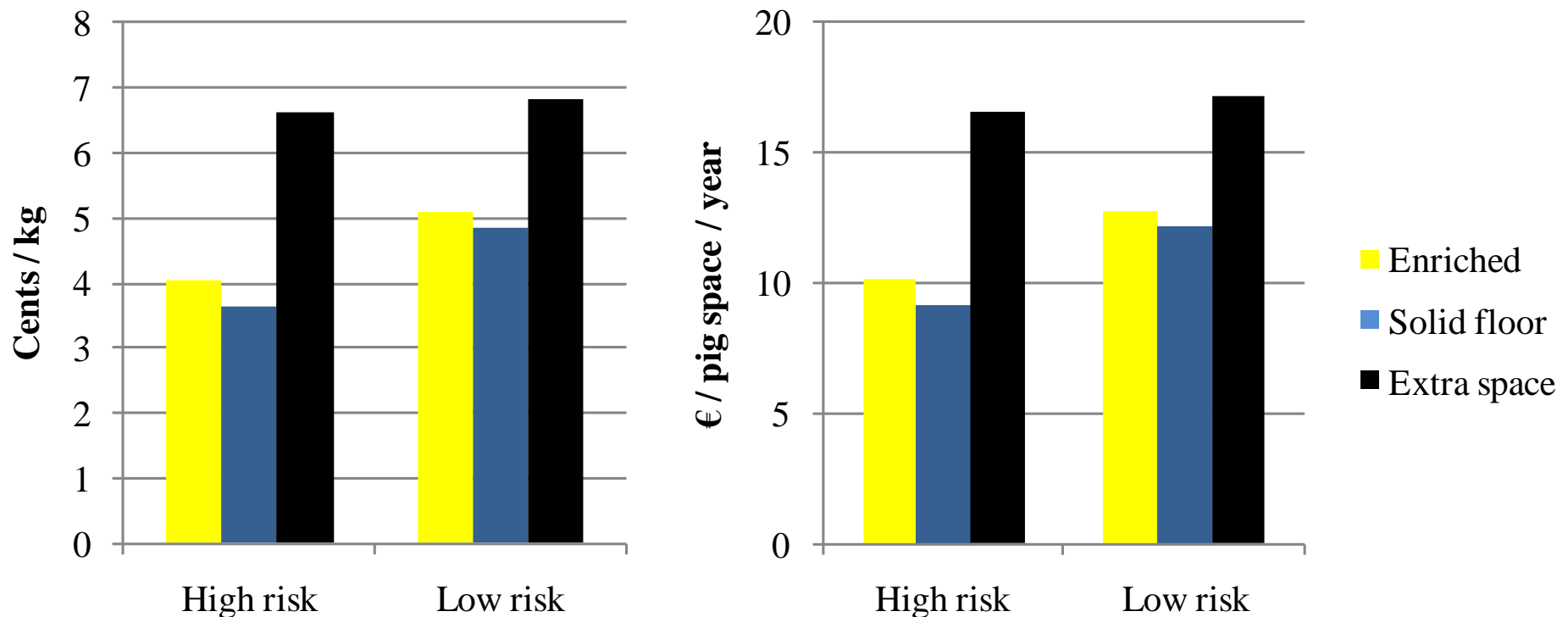


Some hypothetical housing scenarios which may reduce tail biting

Option	Description	High α_1	Low α_1
Basic	Production facility with partly slatted flooring and using a minimal amount of straw as enrichment and 0.9 m ² pen space per pig	0.45	0.30
Enriched	As basic but assumed to use of straw as enrichment	0.10	0.07
Solid floor	Straw-based bedding with solid flooring and plenty of straw and 0.9 m ² /pig	0.05	0.03
Extra space	As basic, but assumes the pig has 35% more pen space allowance	0.40	0.27
No mitigation	Optionally can reduce the effort to mitigate tail biting after observing the first biting in the pen (this option can be used in combination with three others)	0.76	0.56

$$\Pr(n_{t,TB}) = \begin{cases} \alpha_1 & \text{if } n_{t,TB} \equiv 0 \\ \alpha_2 + \alpha_3 \ln(n_{t,TB} + 1) & \text{if } n_{t,TB} \geq 1 \end{cases}$$

Estimated additional revenue (cents/kg, left; €/pig space/year, right) needed for animal welfare improvements to become profitable the producer



Cost scenarios regarding the prevention of tail biting (Niemi et al., 2014)

- 3.5-4 cents price premium per kg pigmeat would be required for a farmer to invest in solid-freedom-based housing or to increase the use of enrichments substantially
- 6-7 cents price premium would be required for a farmer to increase the pen size by 35%

Tail docking

About the study

- The following slides are based on D'Eath et al. (2015).
- The results are not applicable to Finnish production due to the assumptions made in the model (e.g. slaughter weight, TB prevalence, housing), but it shows some interesting results

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Why are most EU pigs tail docked? Economic and ethical analysis of four pig housing and management scenarios in the light of EU legislation and animal welfare outcomes

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The study compared housing and tail docking scenarios

- Tail docking vs. non-docking
- Simulations based on information retrieved from Danish pig production
- Prevalence of TB was based on scenarios

Table 1 *Comparison of cost items of the modelled scenarios in relation to tail biting management practices*

	Standard Docked	Standard Undocked	Enhanced Undocked	Efficient Undocked
	Standard housing with tail docking	Standard housing with no tail docking	Enhanced housing with extra space and straw, no tail docking	More space and straw than Standard, less than Enhanced, no tail docking
Labour cost of tail docking	Yes	No	No	No
Losses due to victims of tail biting outbreaks	Small	Large	Intermediate	Intermediate
Extra variable and fixed costs of reducing tail biting (straw, space)	No	No	Yes	Yes, between standard and enhanced

Summary of costs and revenues when the costs of tail biting were not included in the estimates

Table 2 Summary of costs and revenues (€/pig produced) for the four finishing pig production scenarios in 2012 used in the model when not taking into account potential differences in tail biting and not taking into account potential costs associated with tail biting

Monetary values	Standard Docked (€/pig)	Standard Undocked (€/pig)	Enhanced Undocked (€/pig)	Efficient Undocked (€/pig)
Total revenue	123.93	123.93	123.93	123.93
Total variable costs ^{1, 3}	124.86	124.86	128.87	126.36
Total fixed costs ^{2, 3}	12.71	12.57	14.46	13.39
Gross margin	– 0.93	– 0.93	– 4.94	– 2.43
Net margin	– 13.64	– 13.50	– 19.40	– 15.82

¹Variable cost include: weaner cost, feed, vet and medicine, transport and marketing, straw and enrichment materials, water and electricity, carcass condemnation, interest on capital in animals and interest on capital in variable inputs.

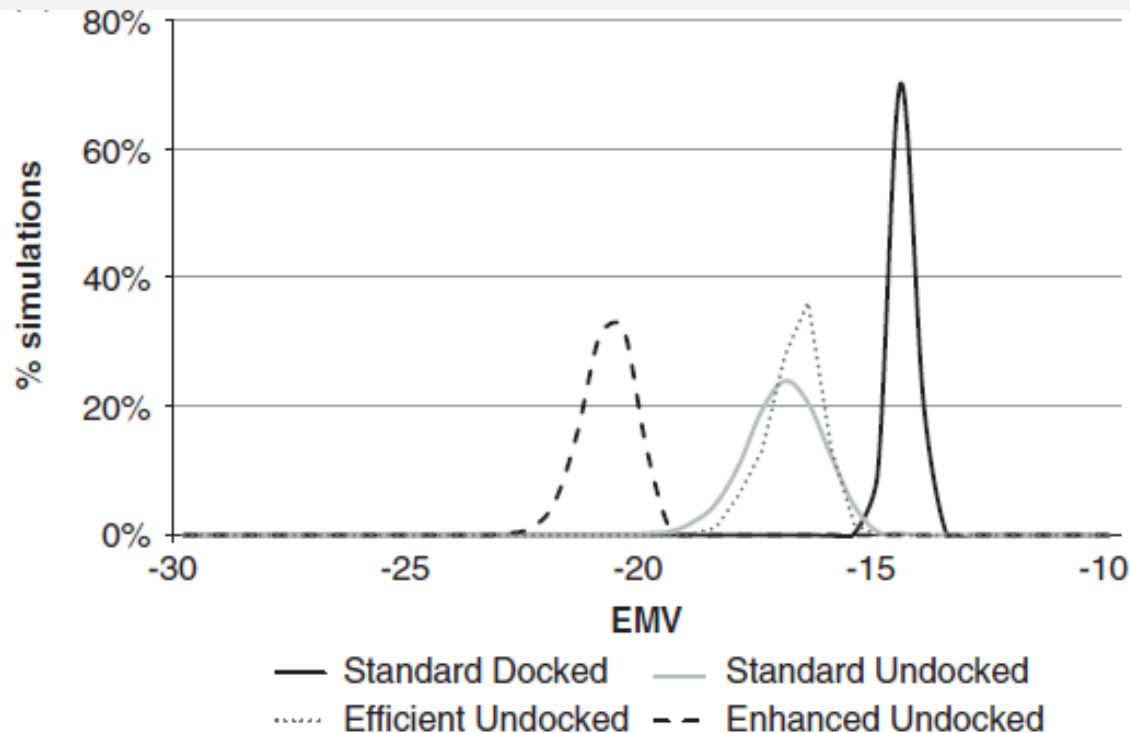
²Fixed cost include: interest and depreciation of fixed capital, insurance and maintenance and labour (including tail docking labour).

³Detailed figures of variable and fixed costs are presented in Table 3.

Simulation results when the risk and uncertainty associated with TB outbreak was taken into account

Mean, standard deviation for TB outbreak to occur in a pen as per scenario

Standard Docked (0.846, 0.05)	→ EMV mean -€14.2/pig
Standard Undocked (0.43, 0.1)	→ EMV mean -€16.8/pig
Enhanced Undocked (0.73, 0.1)	→ EMV mean -€20.6/pig
Efficient Undocked (0.73, 0.1)	→ EMV mean -€15.8/pig





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