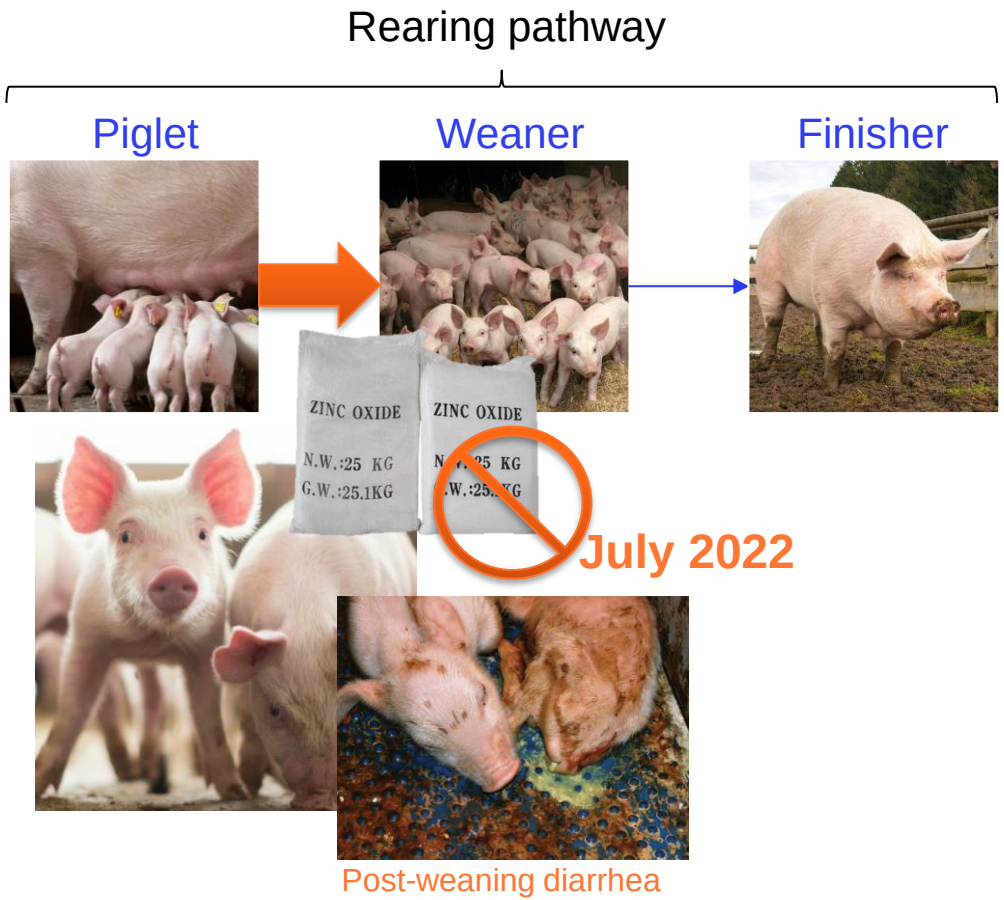
Temporal and structural pattern of AMU in Danish pig herds including the effect of discontinued zinc oxide usage

Unpublished, Josefine Ostenfeld Nielsen

Danish pig production



Age groups

Herd sizes

Production type

Management practices

Variations between farms

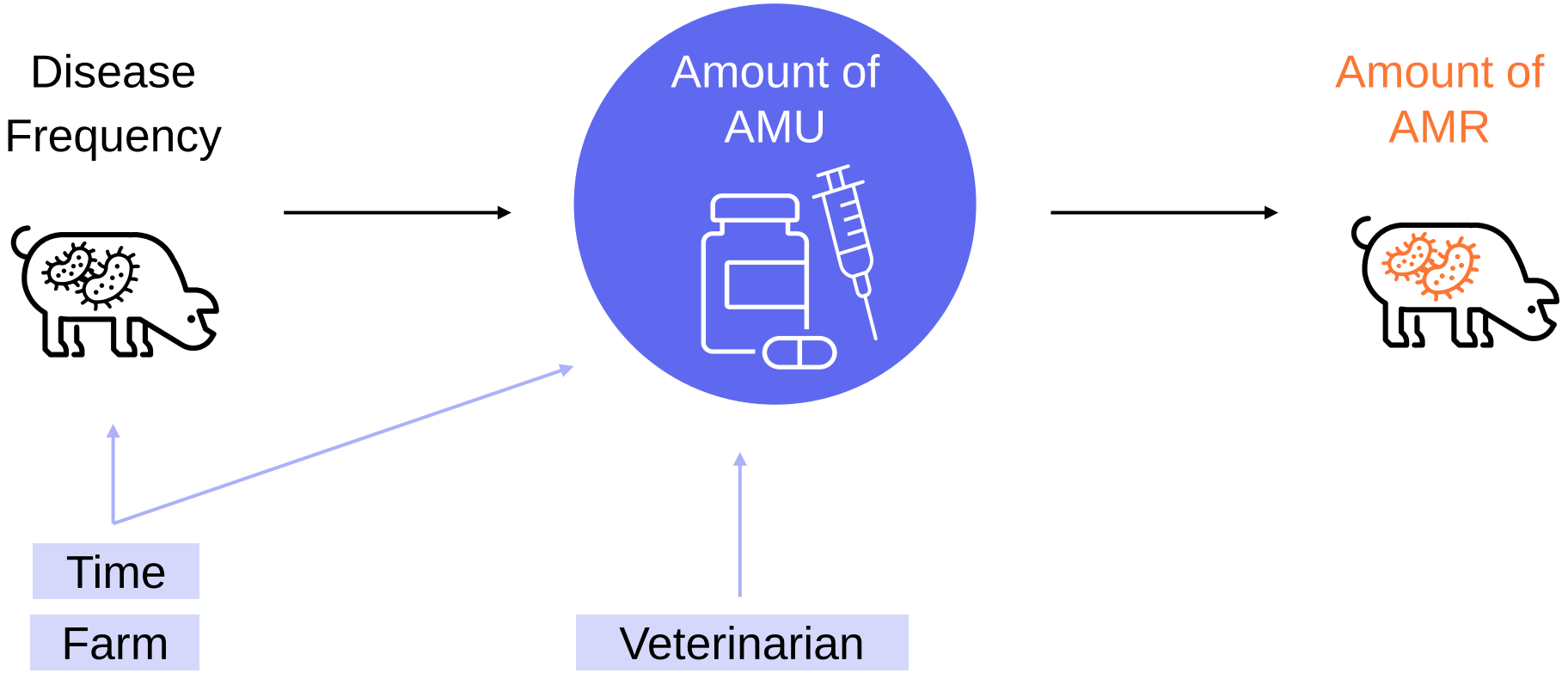
One veterinarian responsible for farm

Management practices

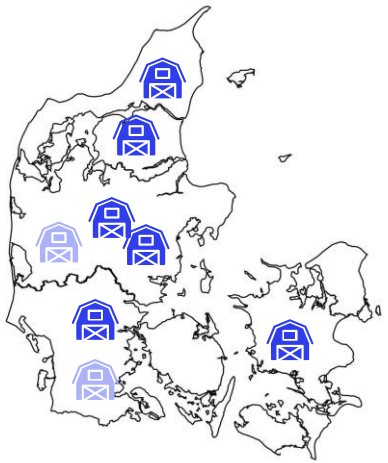
Number of farms they oversee

Variations between veterinarians

Project scope



Study design



Defined study period:

2018-2023 (72 study months)

Defined study population:

Danish conventional, organic, free-range, and breeding farms with a weaner and/or finisher herd with ≥800 pigs

1-72 study months

Ministry of Food, Agriculture and Fisheries of Denmark
The Danish Agricultural Agency

Extracted farm and AMU data from national databases

Data sources

Central Husbandry Register (CHR)

Farm structure:

- Farm ID
- Producer ID
- Production type

- Herd sizes
  - Number of sows
  - Number of weaners
  - Number of finishers

- Date of registered update

The Danish Veterinary Medicine Statistic Program database (VetStat)

Antimicrobial prescription:

- Amount active compound
- Dispensing
- Disease
- Veterinarian ID

- Recipient herd
  - Farm ID
  - Age group

- Date of prescription

Standardized AMU

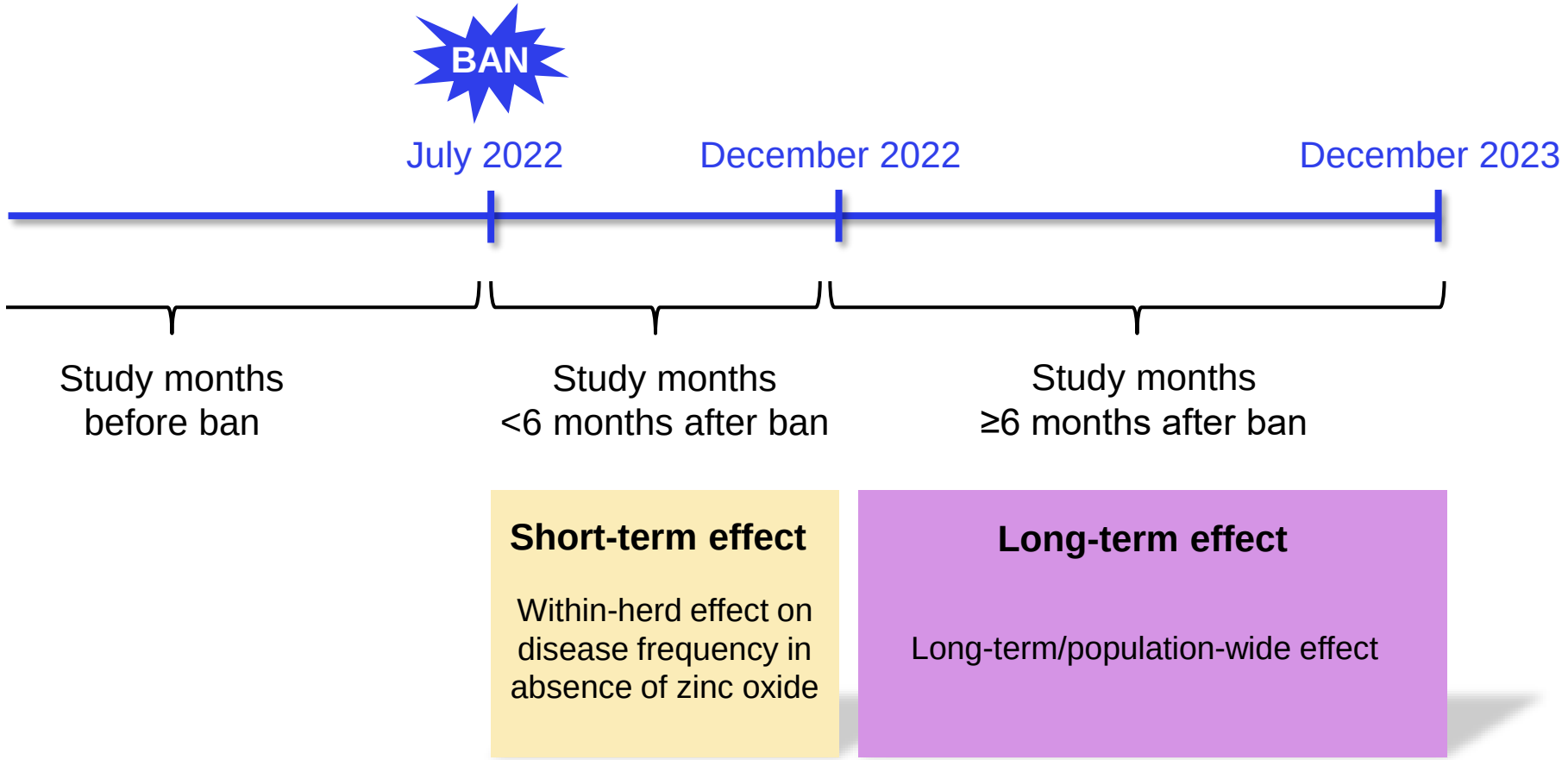
Defined Animal Daily Dose (ADDkg)
Standard dose to treat 1 kg animal per day using the specific active compound

$$[ADDkg]_{date} = \frac{prescibed\ active\ compound\ [mg]}{standard\ ADDkg\left[\frac{ADDkg}{mg}\right] \cdot days\ until\ next\ prescription}$$

$$\left[\frac{ADDkg}{pigday}\right]_{month} = \frac{\sum([ADDkg]_{date})_{month}}{number\ of\ pigs_{month} \cdot number\ of\ days_{month}}$$

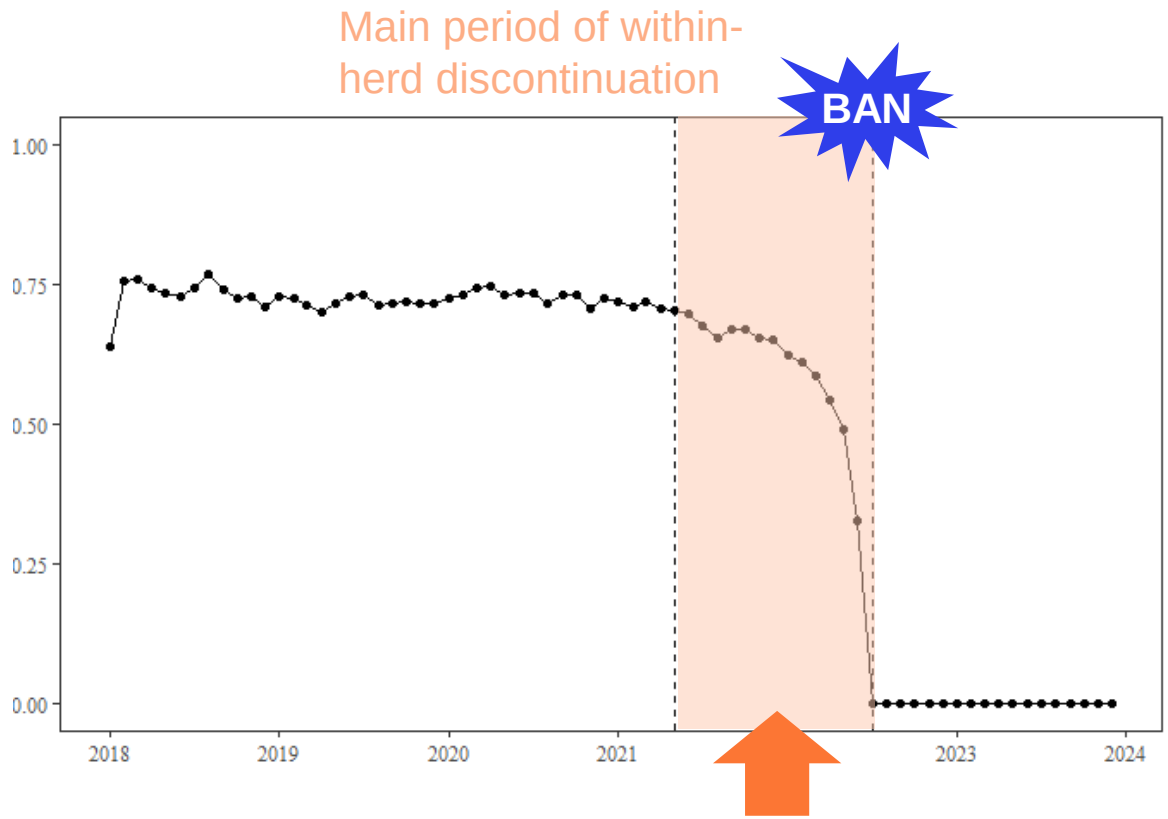
Number ADDkg that each pig within the herd on average was given per day in the study month

Zinc oxide ban



Zinc oxide discontinuation

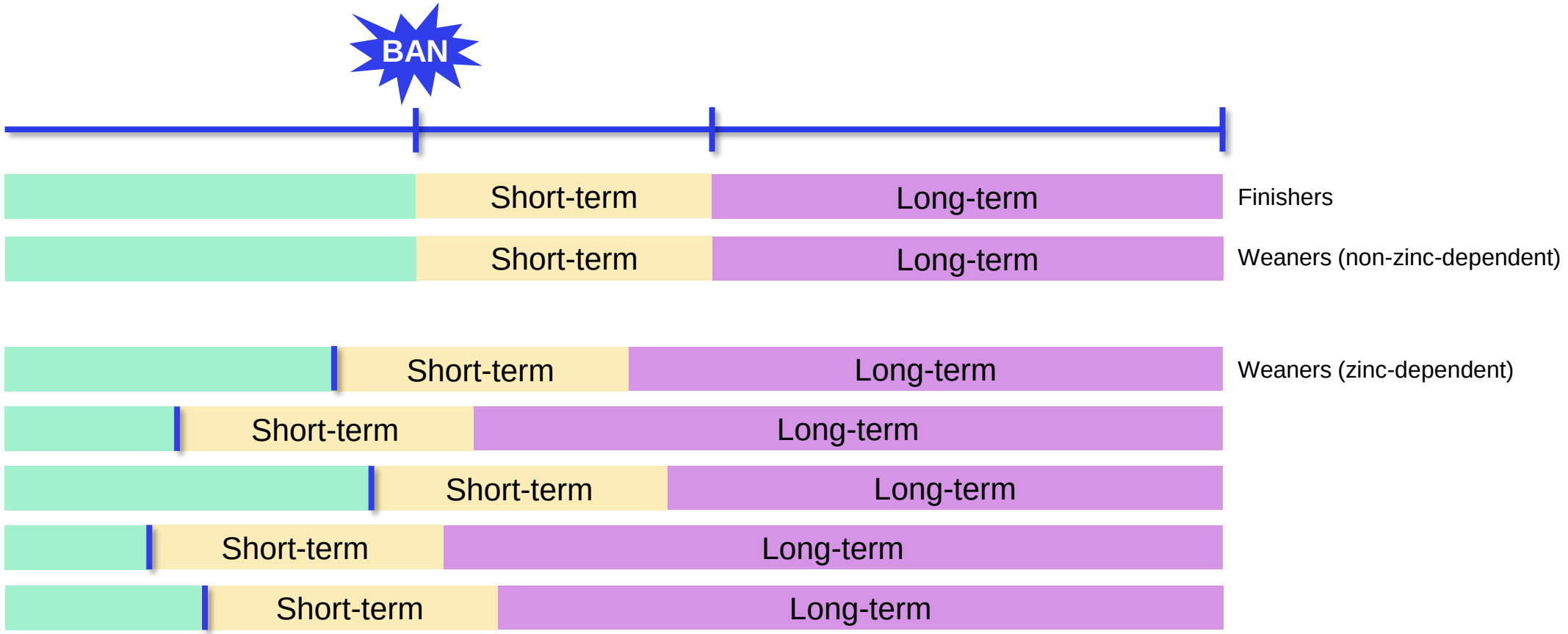
Proportion of weaner herds using zinc oxide



Zinc-dependent weaner farms:

defined as farms that discontinued zinc oxide usage in the year prior to the ban

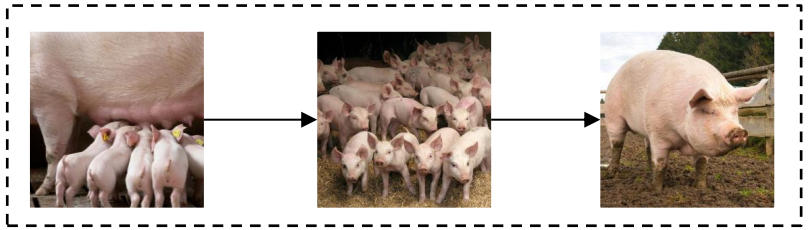
Derived zinc oxide ban/discontinuation variable



Within-herd zinc oxide STOP

Derived pig-movement variables

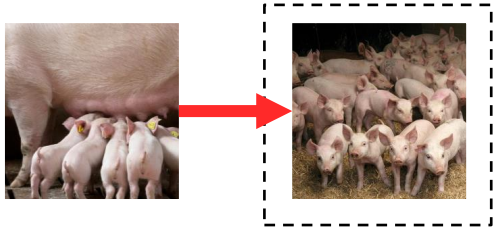
Within-farm production:



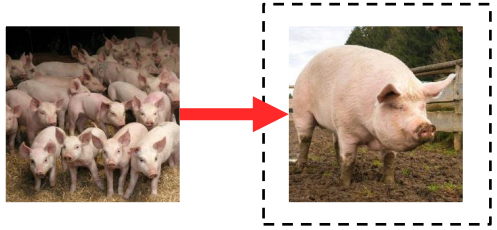
Internal pig movement between rearing stages

Herd depending on **external** pig movement

1.

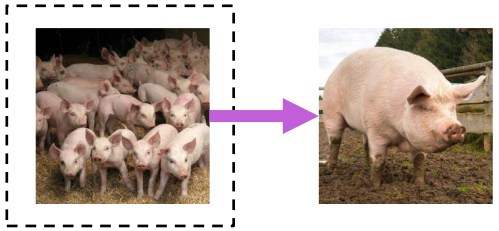


2.



Trading weaners influence AMU?

3.



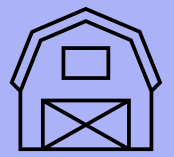
Three-level data

AMU/pig/day

Weaner or finisher herd

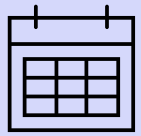
3. Veterinarian

2. Farm



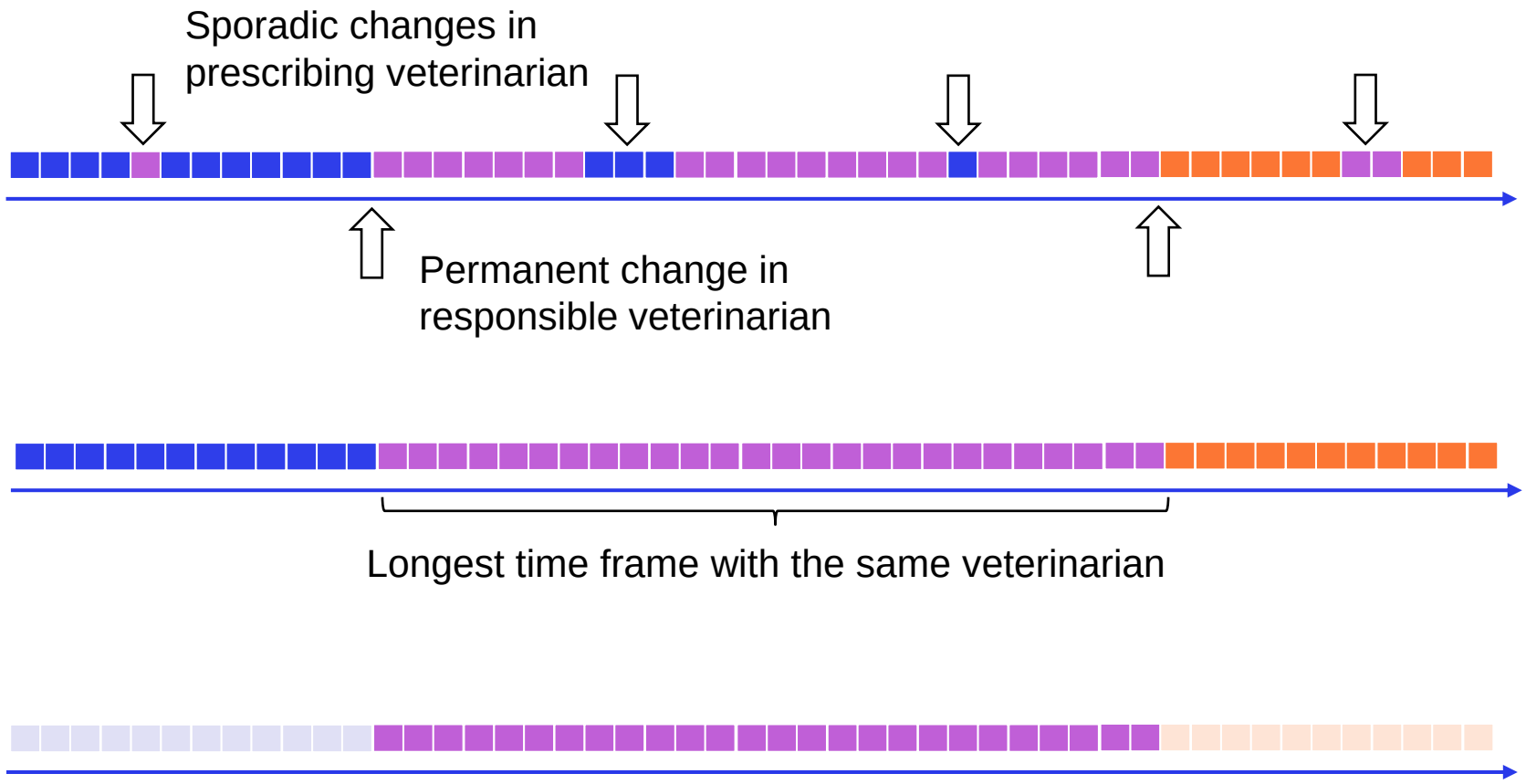
Structural effects

1. Study month

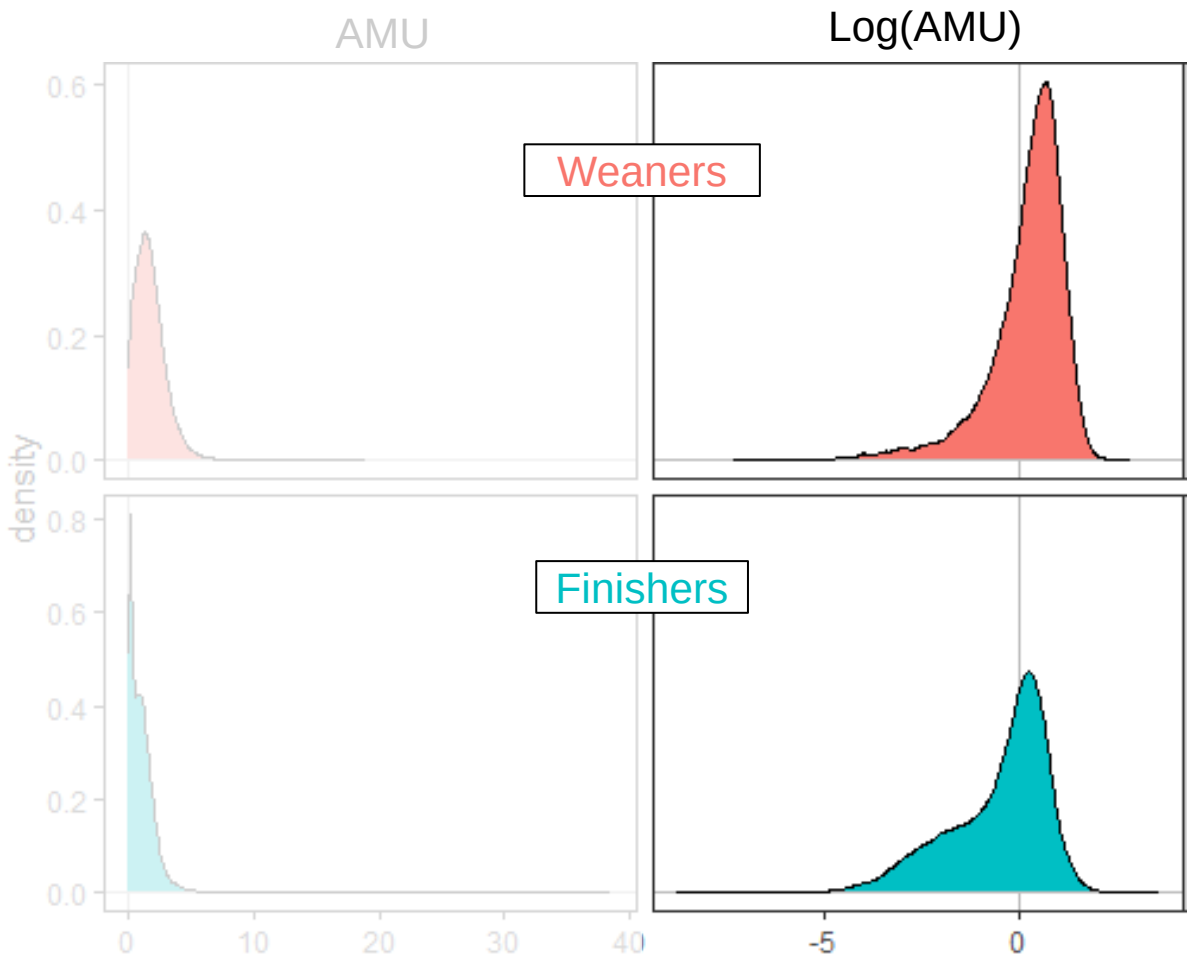


Temporal effects

Three-level nested dataset



Linear mixed-effect model



<u>Temporal fixed effects:</u>

Long-term time effect

Seasonality

Zinc oxide ban/discontinuation

<u>Structural fixed effects:</u>

Production type

Herd size

Pig-movement

No. farms overseen by veterinarian

<u>Random effects:</u>

Random intercept

- Farm
- Veterinarian

Random slope

- Zinc oxide ban/discontinuation

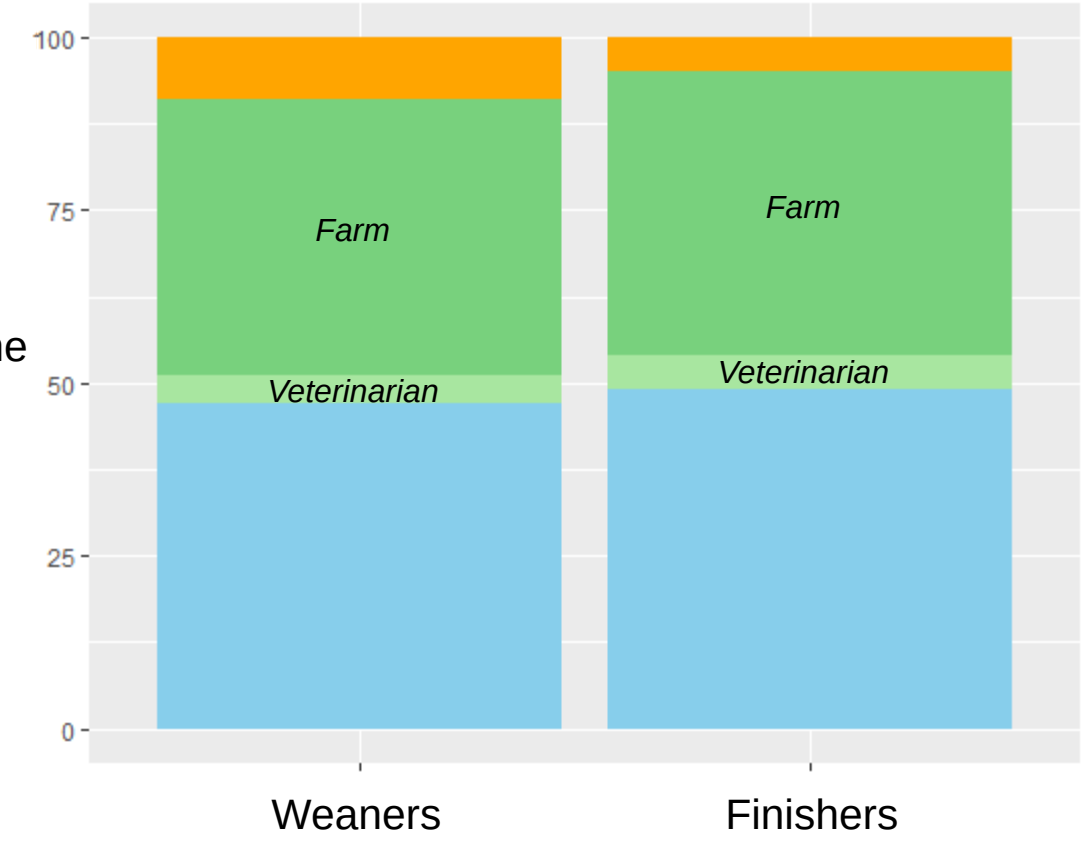
Explained AMU variance

Variance explained by random effects:

~90% farm

~10% veterinarian

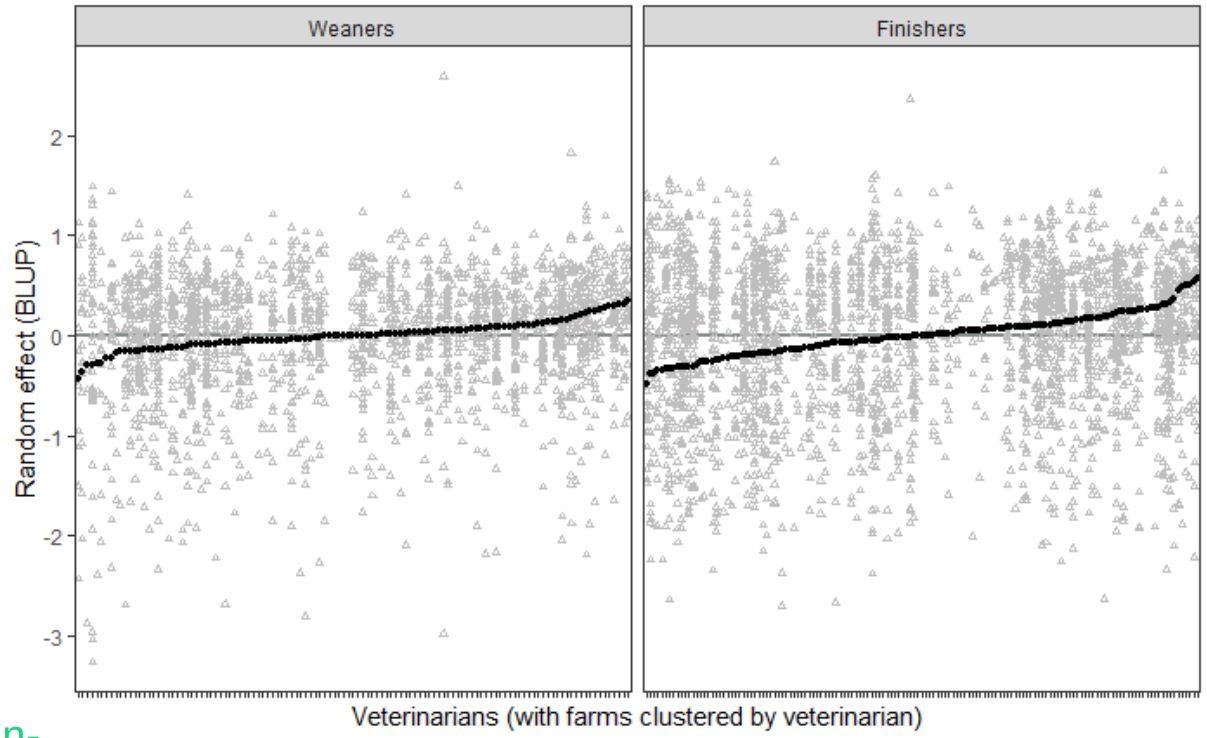
Proportion of the total variance



Variance explained by:

- fixed effects
- random effects
- unexplained

Random farm and veterinarian effects

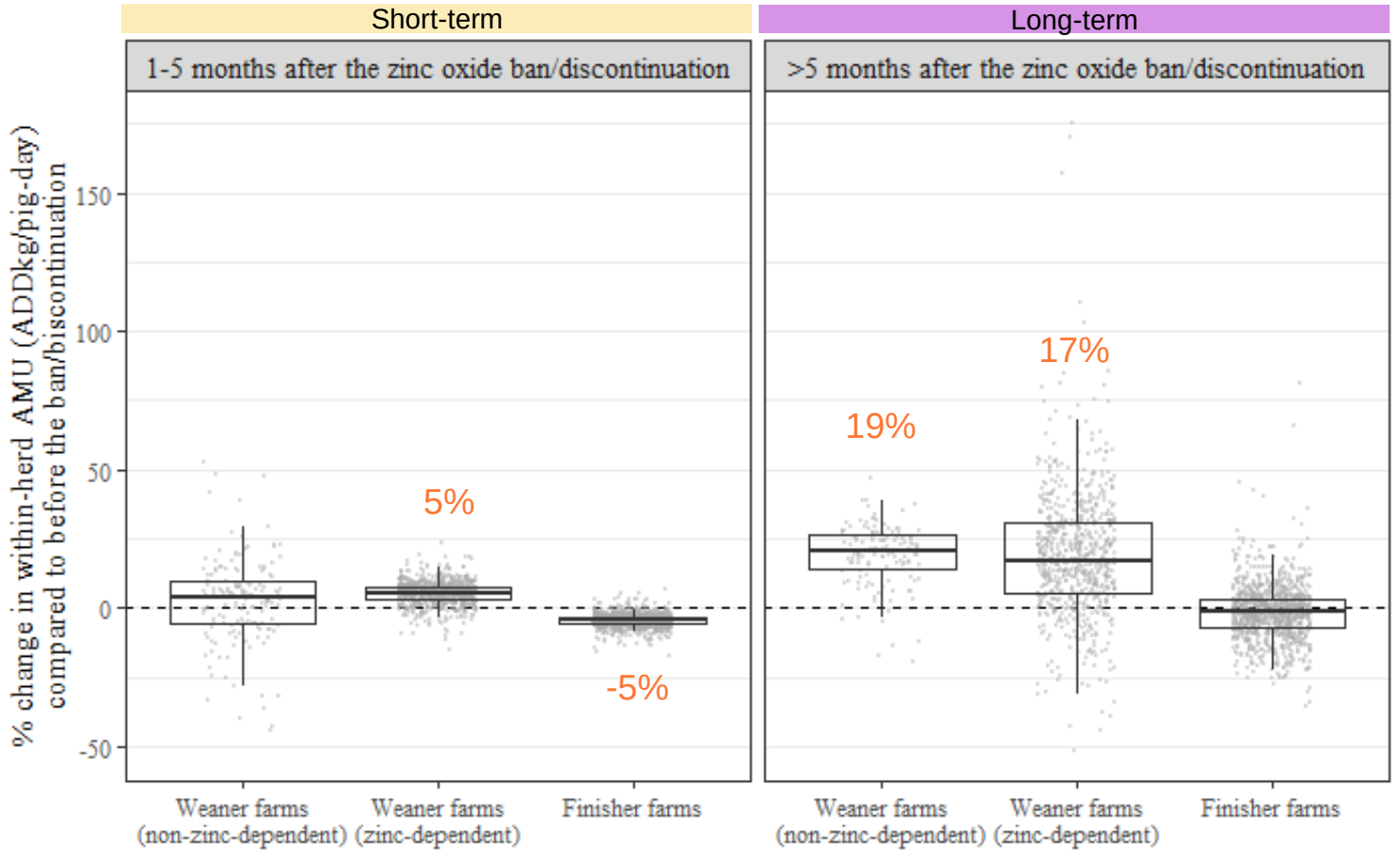


Farm effect

Veterinarian effect

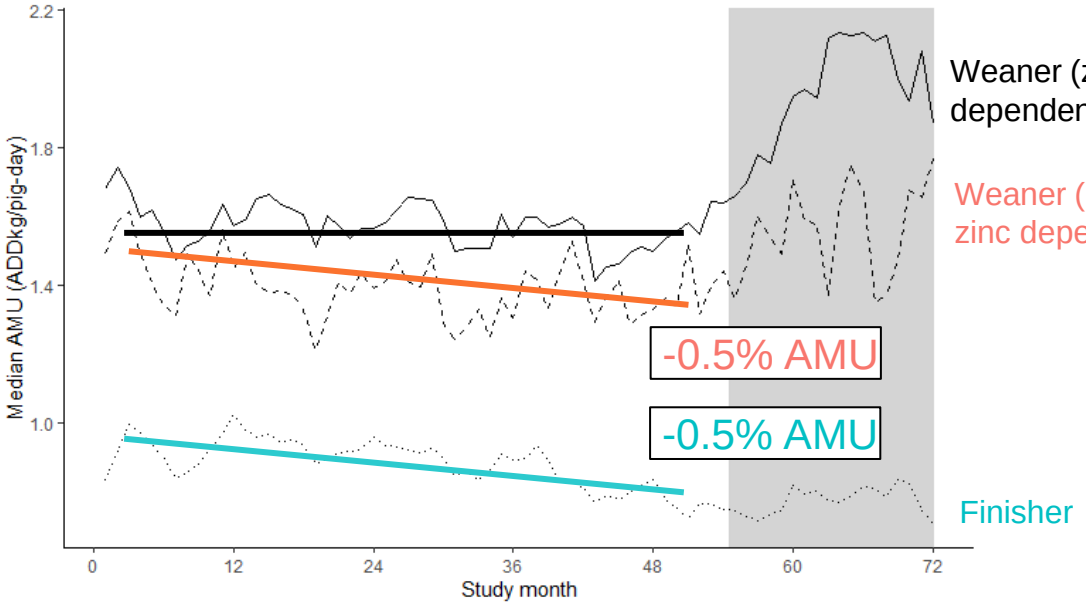
Predicted deviation of the within-herd AMU (log ADDkg/pig-day) from the average population AMU (global weaner or finisher intercept) attributed to individual farms/vets

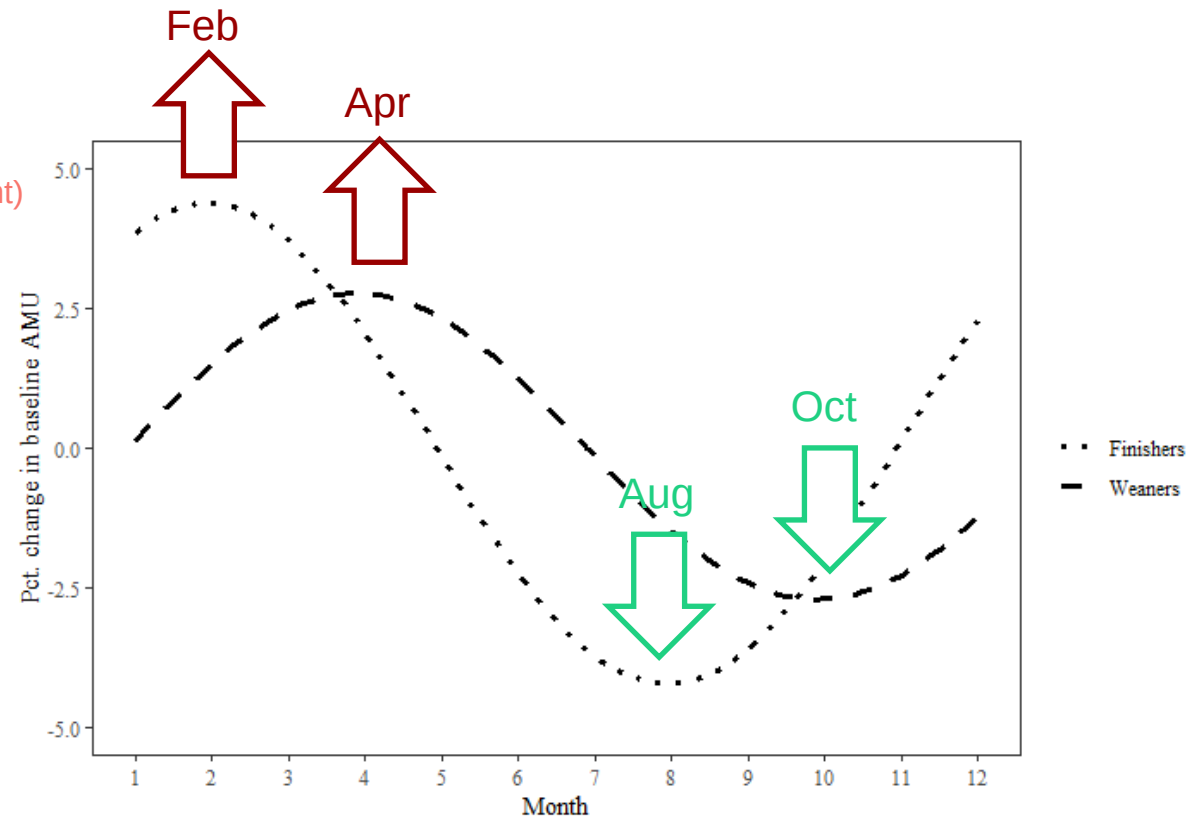
Effect of zinc oxide ban/discontinuation



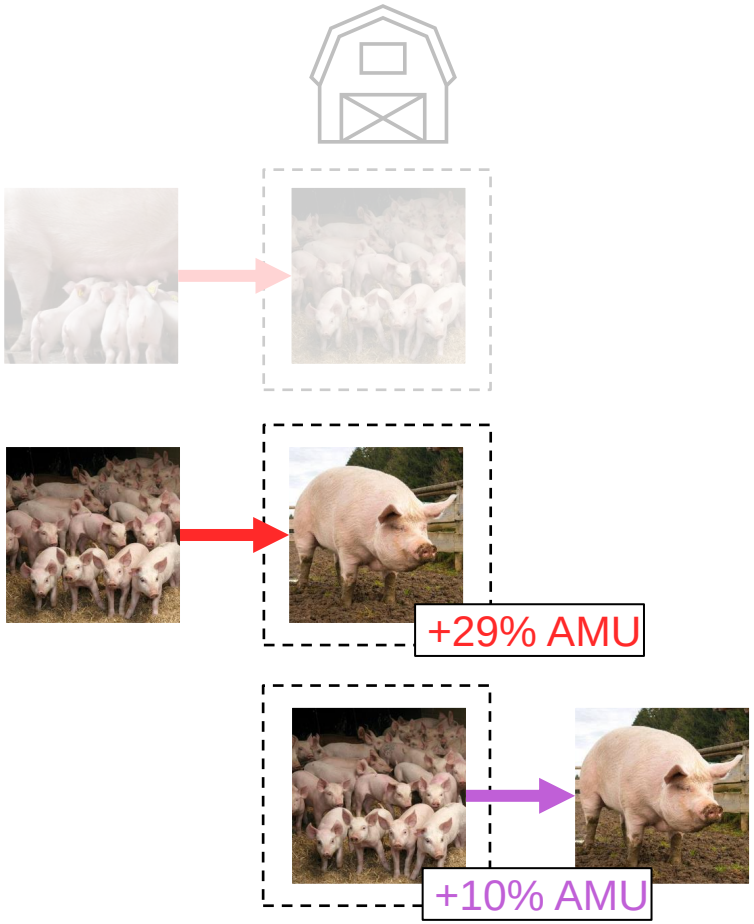
Significant mean % change in AMU compared to before ban/discontinuation

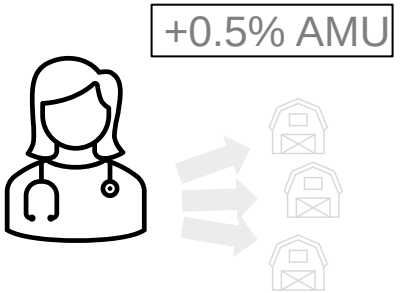
Temporal effects

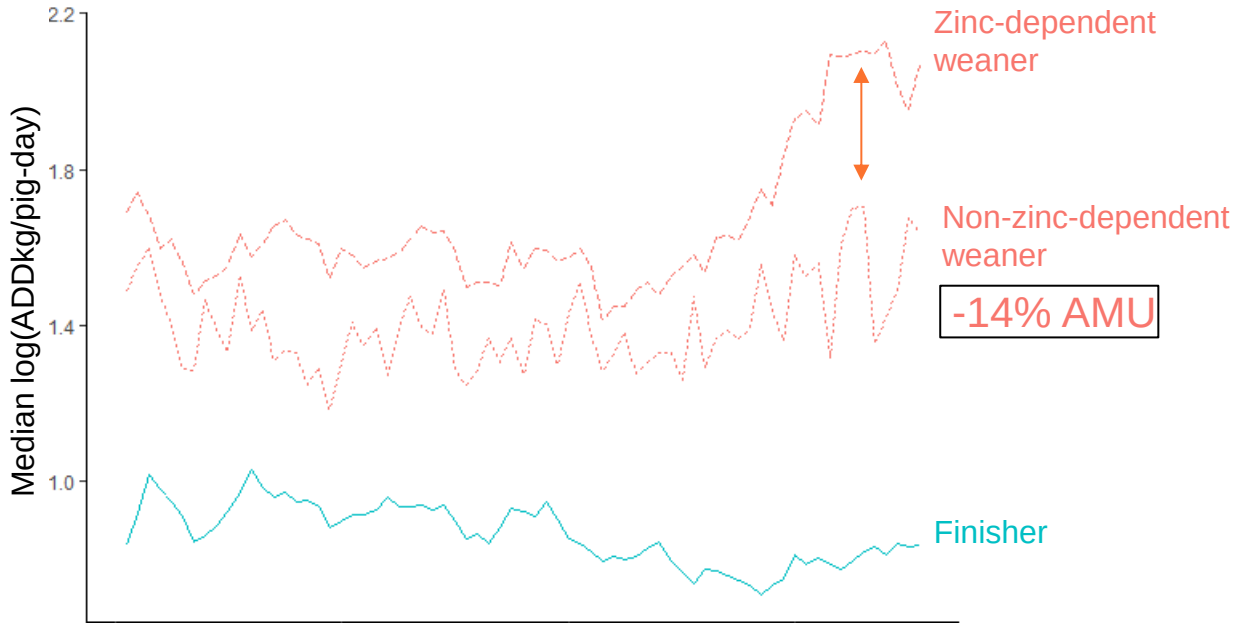




Structural effects







Summary

- Individual farm management is the main predictor of within-herd AMU
- Unknown farm factors influence AMU a lot more than unknown veterinarian factors

- The absence of zinc oxide increased AMU in weaner herds
- This resulted in a short-term decreased AMU in finisher herds

- Herds reduced AMU over time except in weaner herds on zinc-dependent farms

- Relocating and trading pigs after the weaner stage increases AMU


DTU

Sow: https://www.cargill.com/animal-nutrition/species/swine/sow
Weaner: https://www.fwi.co.uk/livestock/livestock-feed-nutrition/expert-guide-to-feed-and-water-requirements-for-weaners
Finisher: http://biruwa.net/2018/01/nepals-untapped-potentialpork-meat-industry/pork-blog/
Sick piglet: https://www.researchgate.net/profile/Jasna_Prodanov-Radulovic/publication/320000496/figure/download/fig1/AS:541731926048768@1506170364053/Diarrhea-in-PEDV-infected-piglets.png
Healthy piglet: https://i.pinimg.com/originals/90/ea/8c/90ea8cab8e440f6f4cc8012d7ebe8e53.png
Zinc oxide: https://5.imimg.com/data5/SELLER/Default/2022/6/RD/FN/EB/149160673/zinc-oxide-1000x1000.jpg
Organic pig: hhttps://landbrugstidende.dk/wp-content/uploads/2023/07/f8f5874b-b615-4287-9941-2e887a548173-1024x683.jpg
Organic label: https://th.bing.com/th/id/R.478c39acea51a61abc15570406944c7b?rik=btc4t8i%2fem6aSA&riu=http%3a%2f%2froerkjaerhereford.dk%2fwp-content%2fuploads%2f2016%2f02%2f%C3%98ko-logo.png&ehk=nWOzYDwvh2zxfR4cPGVVuSyUj8UDeXpiDWbnkzq37gE%3d&risl=&pid=ImgRaw&r=0