Novel resilience indicators based on egg production in laying hens

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Resilience is measurable

- Resilient animal = minimal effect of disturbance or rebounces rapidly

Measurable → Indicators

Several indicators – often deviation from expected

Poppe et al. (2020)
Adriaens et al. (2023)
Gorssen et al. (2023)
Bedere et al. (2022)
Berghof et al. (2024)

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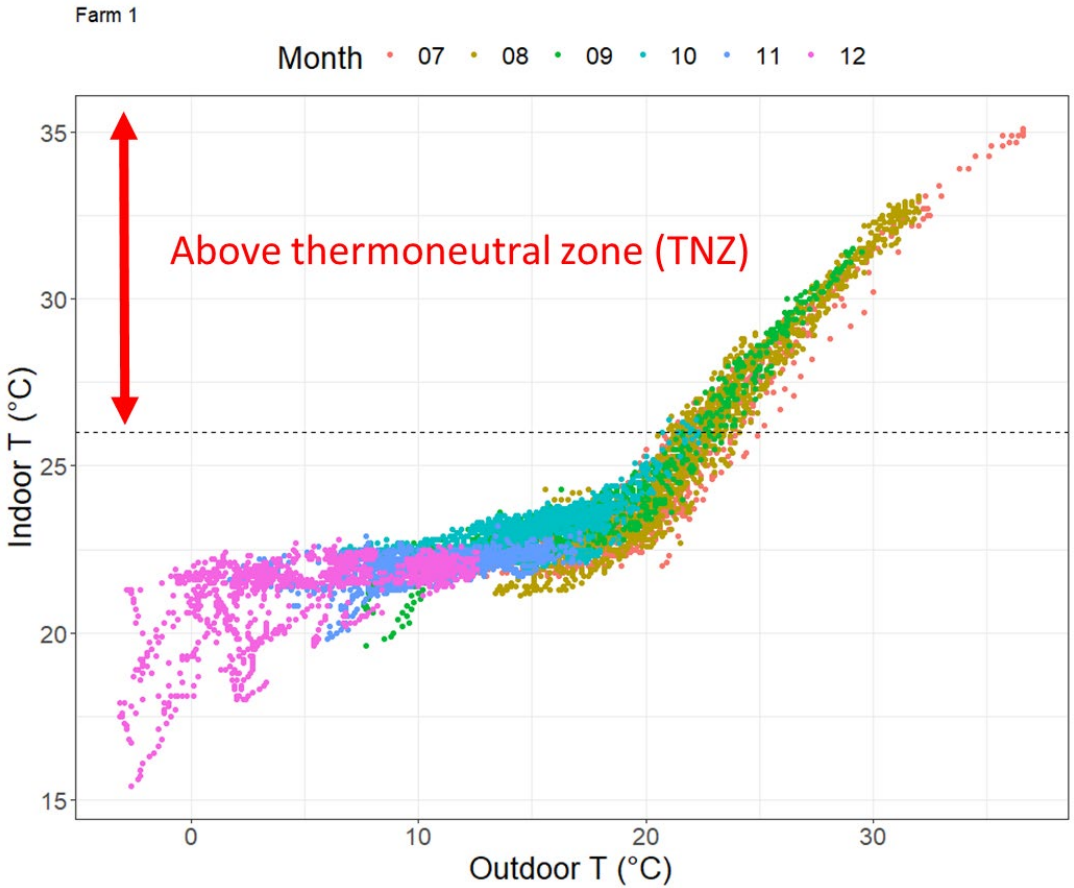
“Heat stress is not an issue in indoor-housed livestock.”

Heat stress resilience (heat tolerance)



Also important indoors & scarce information on poultry

(reviewed by Fodor et al., 2023)

Aims of this study

Define resilience indicators using **daily** egg production in laying hens

Analyse their relationship with production and heat tolerance

Data - birds

- Brown layers
- 11 flocks from 4 test farms in NL and BE
- Daily egg production and mortality
- Unit of observation: cage (n = 21,916; 8.8 hens/cage on avg.)
- Trait:

$$Laying\ rate\ per\ day\ (LR, \%) = \frac{No.of\ eggs}{No.of\ hens} * 100$$

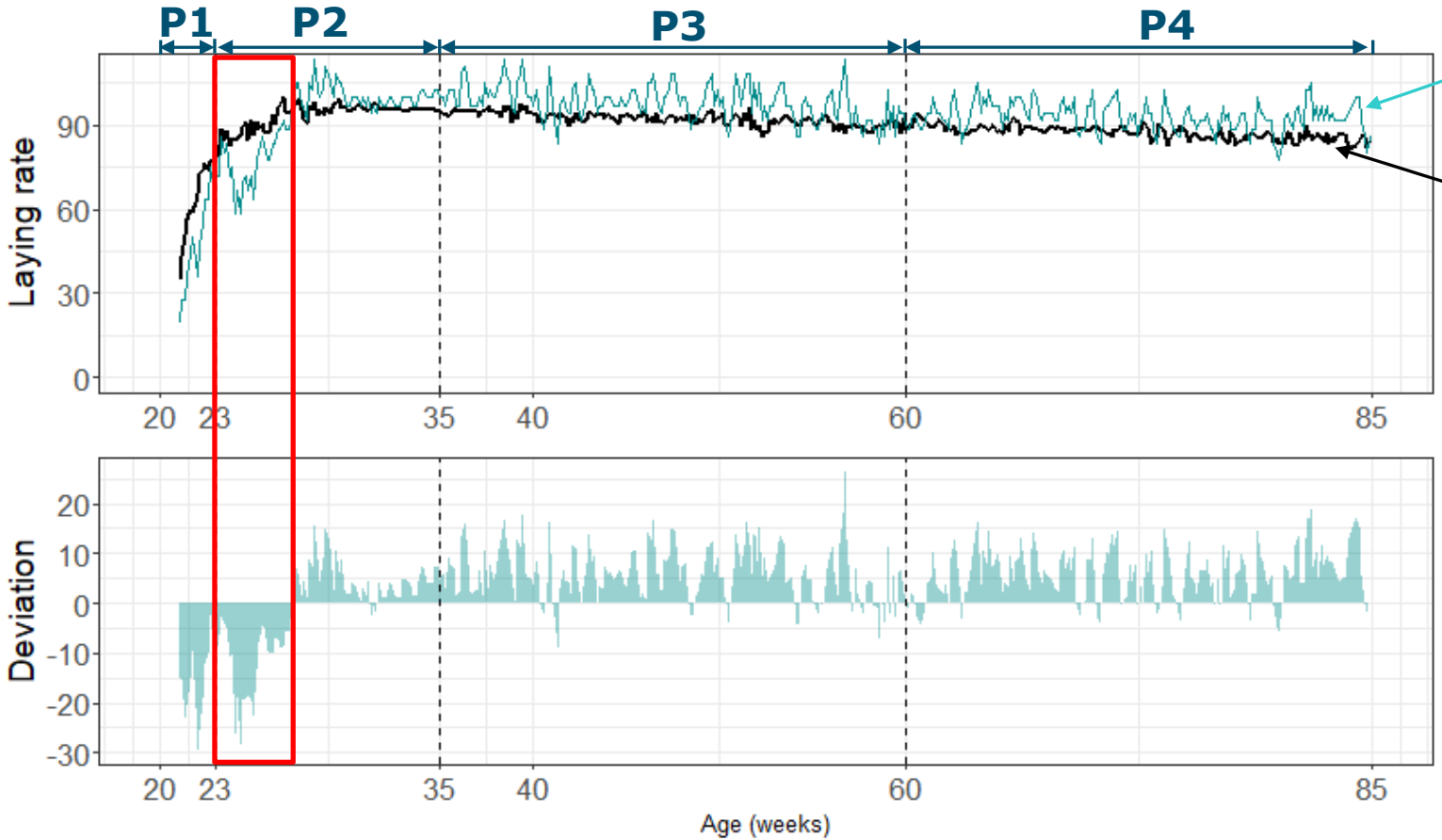
- Egg laying cycle may be missed (manual collection @specific time)

→ smoothed LR (3-day moving average)

Data - weather

- Hourly weather data from NL and BE
- Farms matched with closest weather station (ZIP code)
- Distance farm-to-station: 3.1-25.1 km (mean: 13.9 km)
- Mean THI of last 7 days
- Daily mean T: -7.0 – 30.1°C
- Daily mean THI: 20.9 – 69.0

LnVar of daily deviations as resilience indicator



Actual LR

Expected LR
(i.e., flock mean)

Daily deviations →

InVar per period
(P2 – P4)

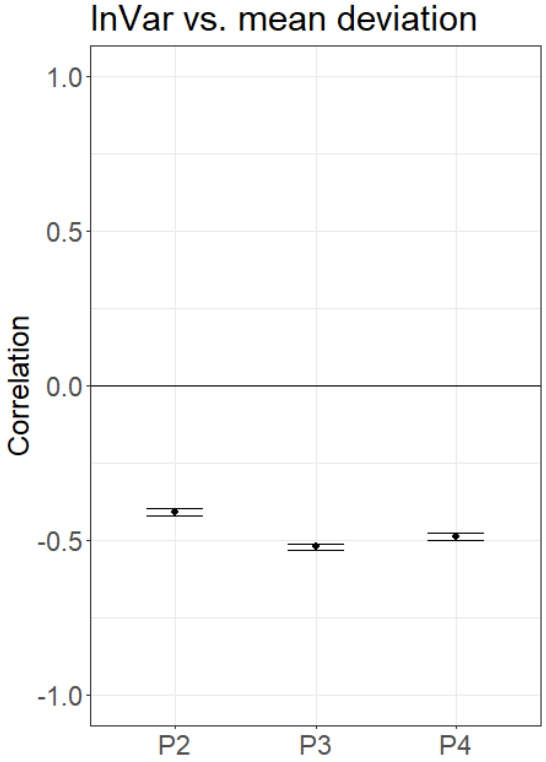
Higher lnVar ~
less resilient

Statistical analyses

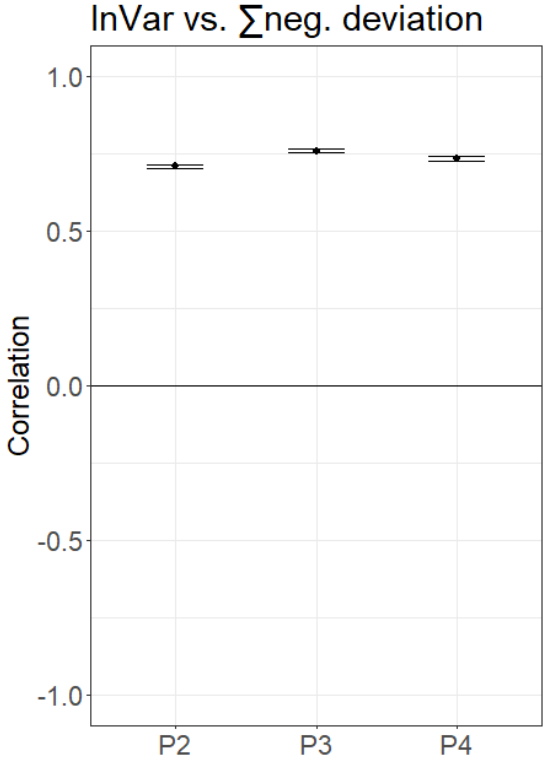
- Random regression using first-order Legendre polynomial on 7-day mean THI → THI intercept and slope per sire
- Spearman's rank correlation:
    - LnVar vs. production indicators within cage per period
    - Mean lnVar vs. THI intercept and slope per sire

Results – production

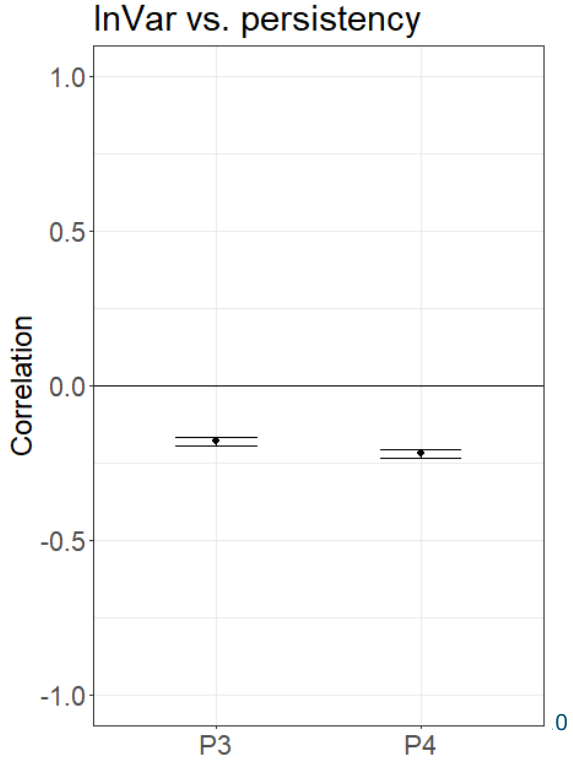
Higher lnVar ~
lower relative production



Higher lnVar ~
more production lost vs. expected

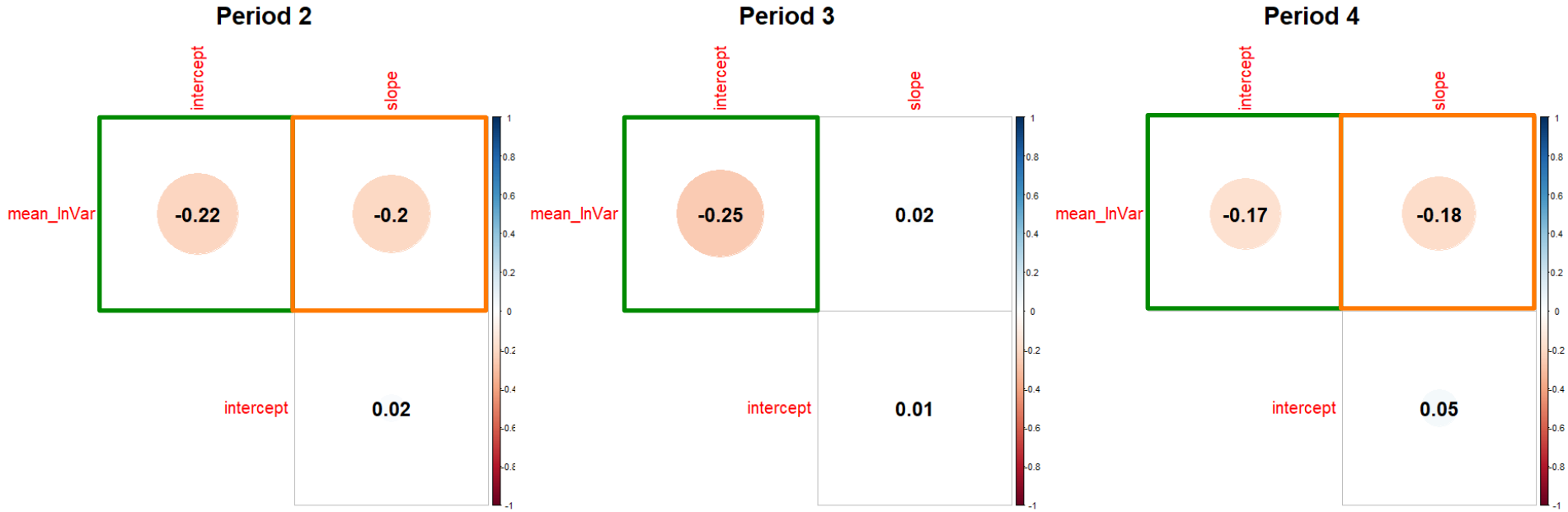


Higher lnVar ~
less persistent production



Results – heat tolerance

Mean lnVar per sire vs. 7-d mean THI intercept & slope of LR per sire



Higher mean lnVar ~ lower production at thermoneutral circumstances
~ more negative 7-d mean THI slope (Period 2 & 4)

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Conclusions

- LnVar captures stability of egg production using daily data
- More stable production (lower lnVar)
    - Higher production level
    - Slightly better persistency
    - Slightly more favourable heat tolerance slope (Period 2 & 4)

Acknowledgements

CRV
BETTER COWS > BETTER LIFE

Topigs Norsvin
PROGRESS IN PIGS

HENDRIX GENETICS

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Data-Driven Discoveries in a Changing Climate program of WUR

Thank you for the attention!

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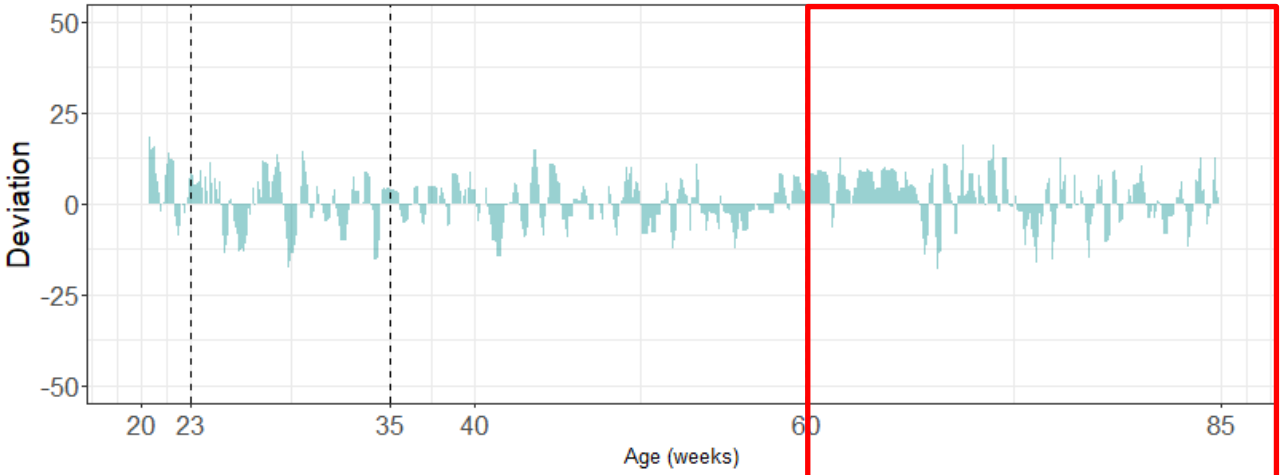

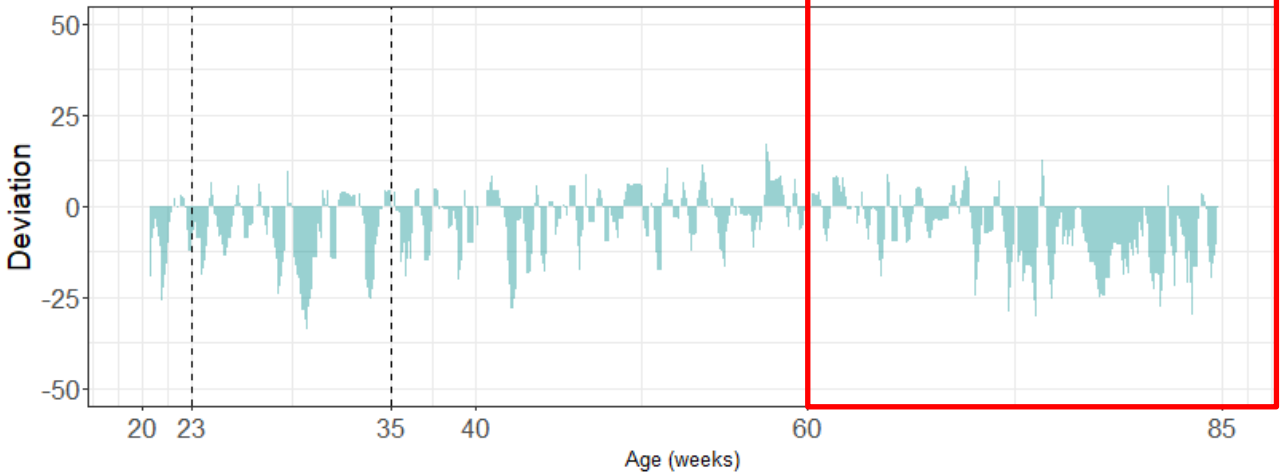

Lower lnVar
More resilient

Higher lnVar
Less resilient

InVar across periods