



THE UNIVERSITY of EDINBURGH
Royal (Dick) School of
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Inferring stresses (challenge levels) from farm effects

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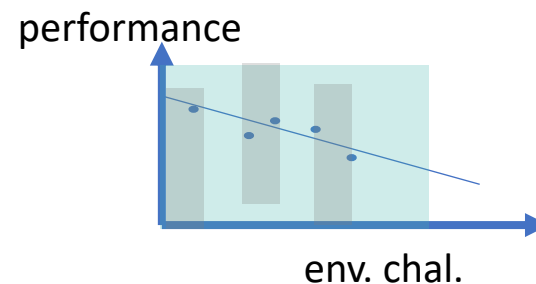
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- Unknown challenge level (t)

$$y = y_0 + y_1 \cdot t$$

Assumption

- A non-genetic factor which categorises level of challenge is available (e.g., farm, herd-year-season, etc)
- Individuals in the same contemporary group have similar challenge levels
- Realised average performance is negatively related to challenge level



Two step reaction norm

Step 1:

$$y = \mu + \hat{F} + \hat{A} + E$$

\hat{F} : farm effect

- Can also drop $\hat{A} \rightarrow y = \mu + \hat{F} + E$ [Finklay and Wilkinson 1963]
 - \hat{F} will contain genetic effect!
 - However, if the distribution of phenotype is random (and not assortative) the average F is zero

Step 2:

$$y = \mu_0 + A_0 + E_0 + f(\mu_r + A_r + E_r)$$

f : challenge levels (scaled farm effect from step 1)

Scaling farm effects

- $y = \mu + \hat{F} + \hat{A} + E$

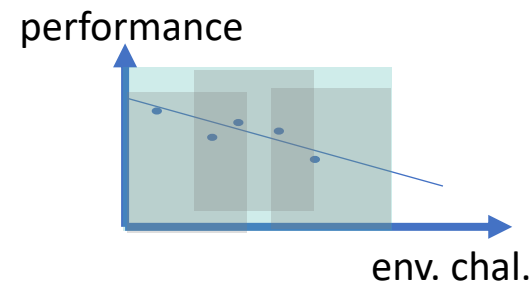
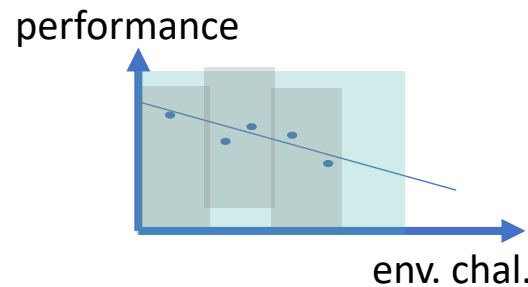
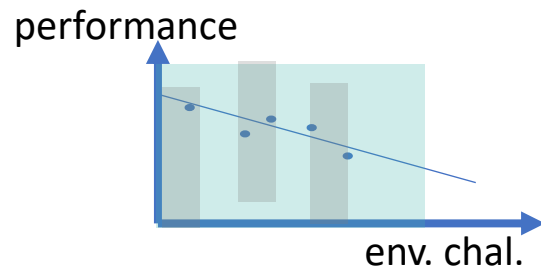
Based on assumption of reduced performance in presence of challenge

- $\max(\hat{F})$: farm with maximum production, therefore lowest challenge (X_{\min})
- $\min(\hat{F})$: farm with minimum production, therefore highest challenge (X_{\max})

- $f = X_{\min} + \frac{X_{\max} - X_{\min}}{\max(\hat{F}) - \min(\hat{F})} (\max(\hat{F}) - \hat{F})$

Uncertainty in estimated challenge level

- All animals in farm “ x ” will be assigned with challenge level \tilde{F}_x
- Farms can have different variability in challenge level (e.g., can be associated with management)
- Range of farm can affect accuracy

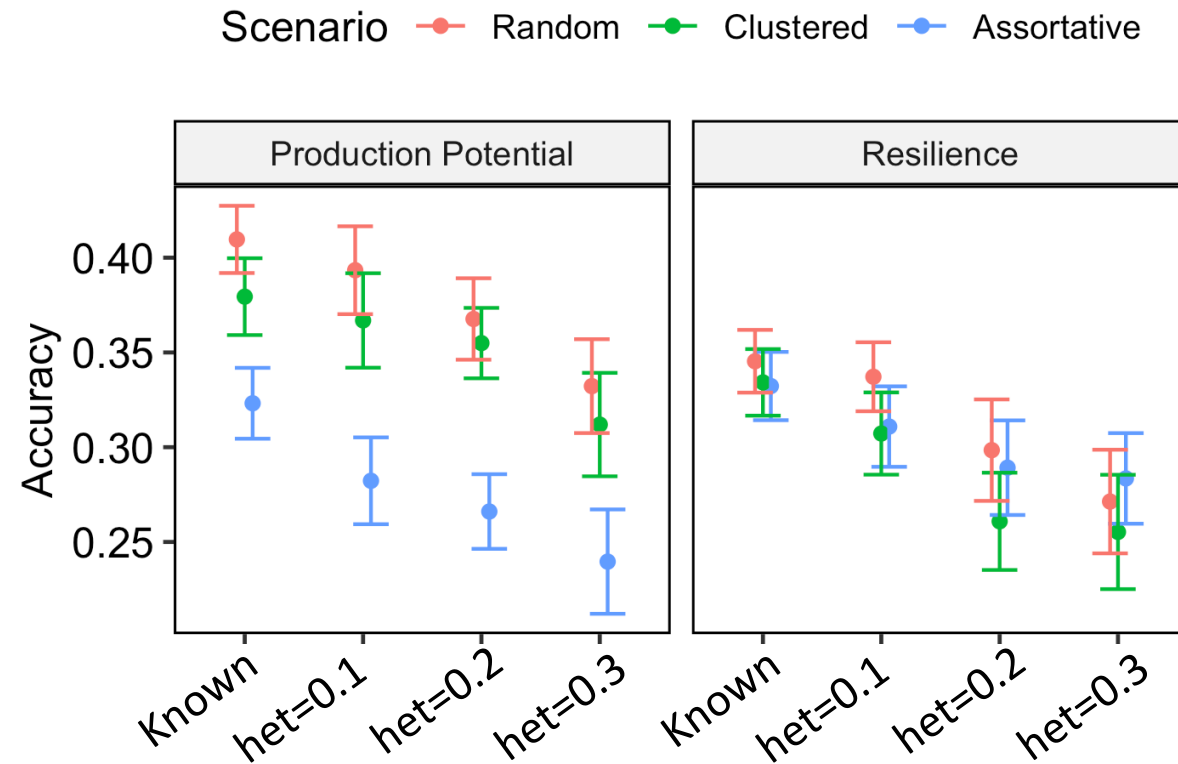


Range of farms in dark green

- Heterogeneity of farm $x = \frac{\text{range of a challenge levels in farm } x}{\text{range of challenge levels for all data}}$

Uncertainty in estimated challenge level

- The more heterogenous the herds, the lower the accuracy
- Best accuracy for production potential obtainable from random allocation scenario



References

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Thank you for your attention

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