# Heat tolerance and farrowing rate in two sow lines

Summary of a PhD project

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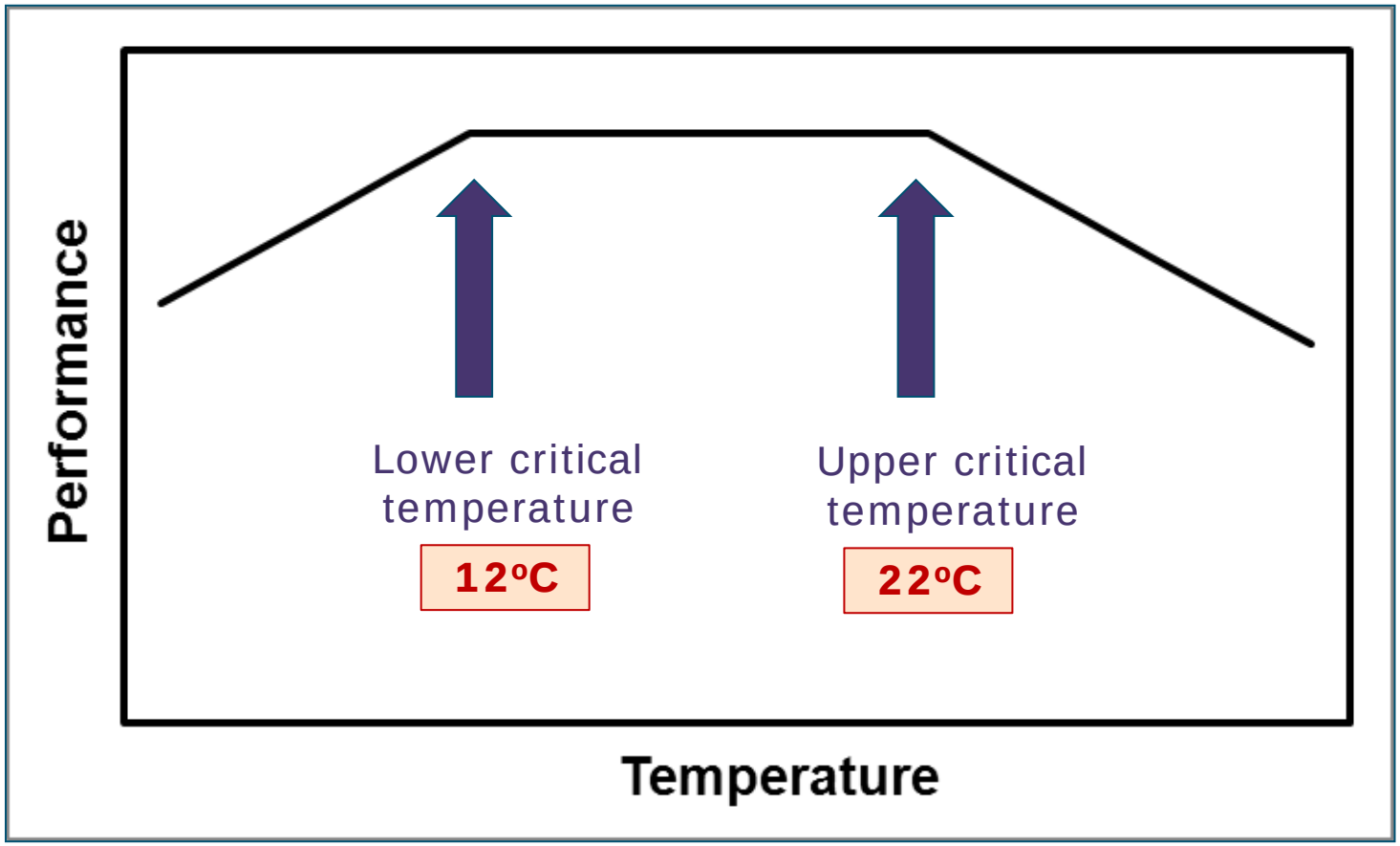
# Background

- Globalization of pig breeding programs
- Meat production is expected to double
  - Latin America
  - South and East Asia

*FAO, 2006*

- Temperature is expected to increase worldwide

# Temperature sensitivity




*After Black et al., 1993*

# Temperature sensitivity

- Above the upper critical temperature (UCT) performance decreases
- Speed of decrease indication of degree of sensitivity

- *Is that the same across genetic lines?*
- *If not, what is the heritability for heat tolerance?*

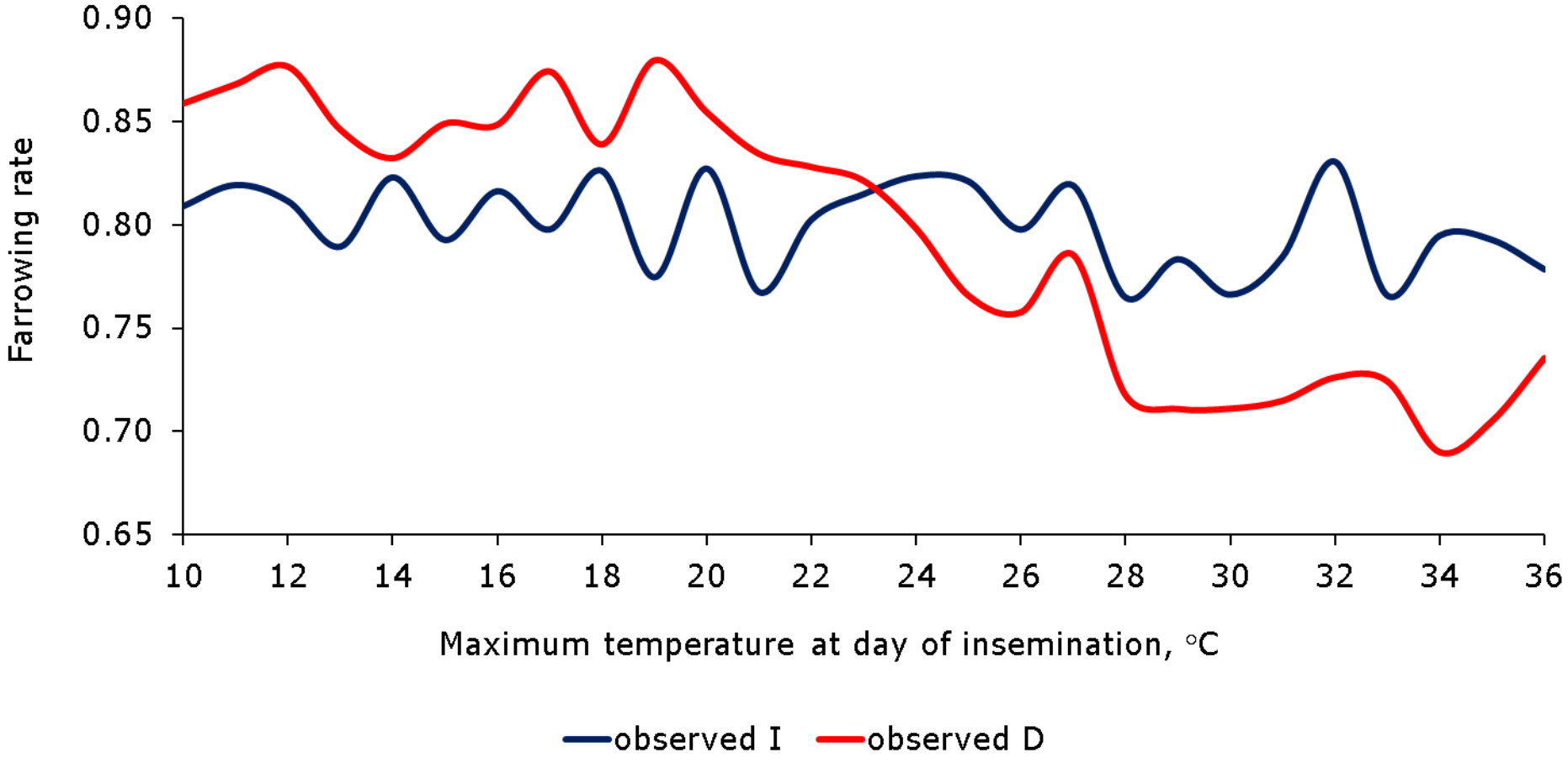
# Data

- Yorkshire (D-line) and Large-White sows (I-line)
  - D-line mainly selected based on performance in the Netherlands
  - I-line selected based on international performance (incl Spain and Brasil)

- Temperature data was available from local weather stations (European Climate Assessment Dataset)
  - Temperature at day of first insemination

# Temperature at insemination and farrowing rate

*32,631 records from 11,935 sows located in Spain*

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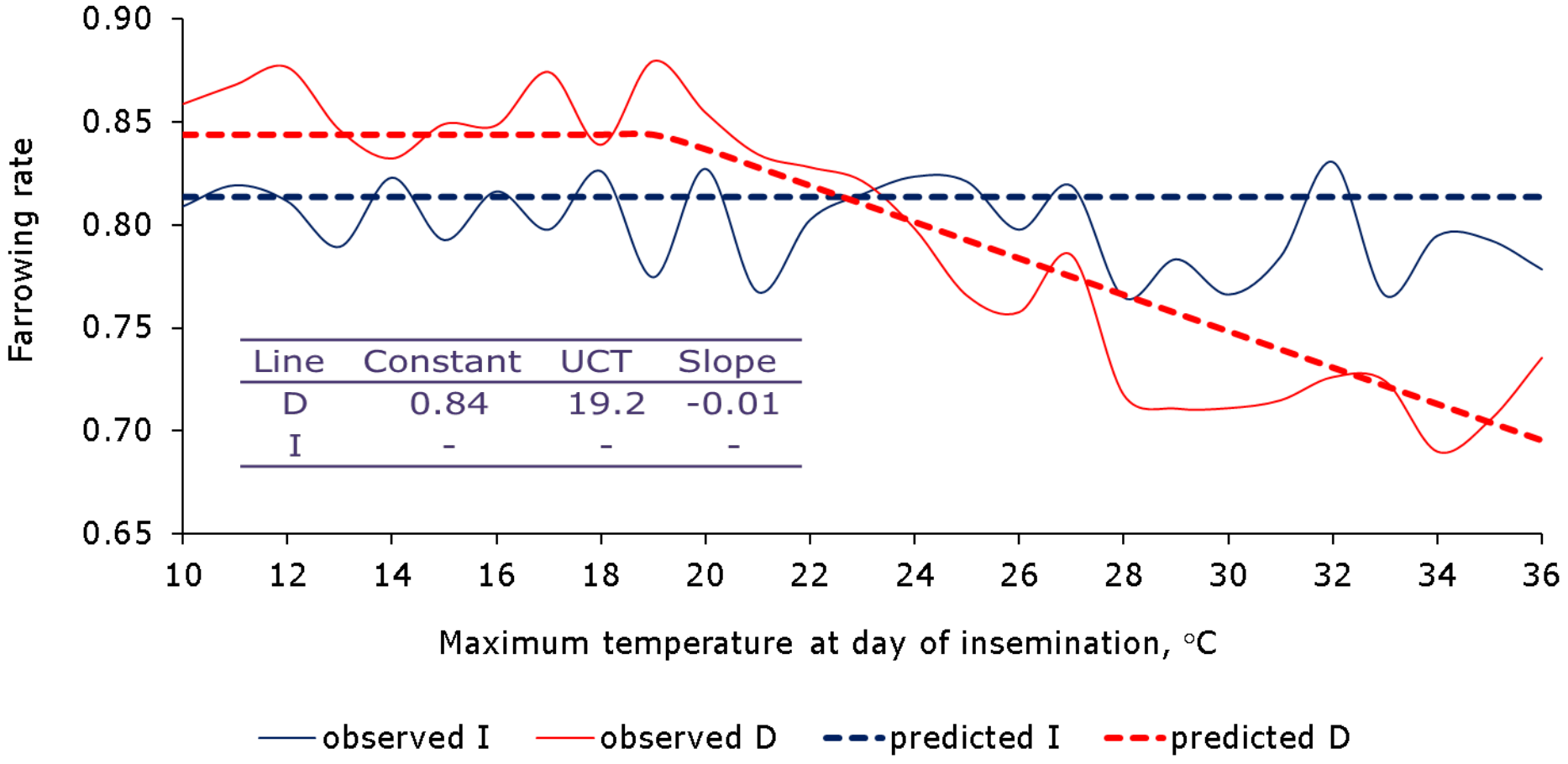
# Temperature at insemination and farrowing rate




| Line | Constant | UCT | Slope |
|---|---|---|---|
| D | 0.84 | 19.2 | -0.01 |
| I | - | - | - |

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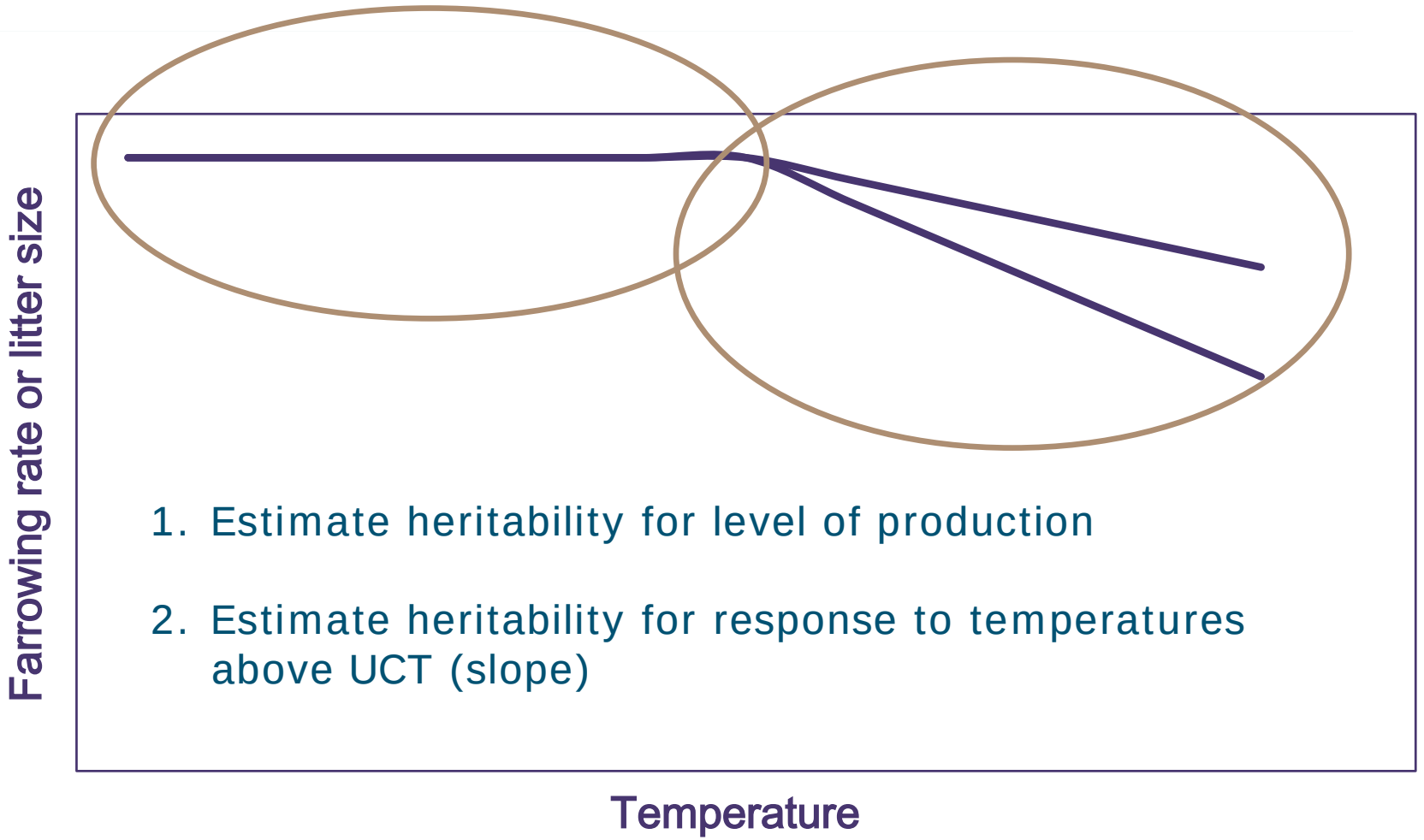
# Line differences?

- The **D-line and I-line respond differently** to temperature **above UCT** at day of insemination, expressed in **farrowing rate**

- Is this response heritable?

# Genetics of temperature sensitivity

*93,969 records from 24,456 sows located in Spain/Portugal*



$$y_{i..mn} = \text{fixed} + a_m + f(i) \times v_m + p_m + f(i) \times q_m + e_{i..mn}$$

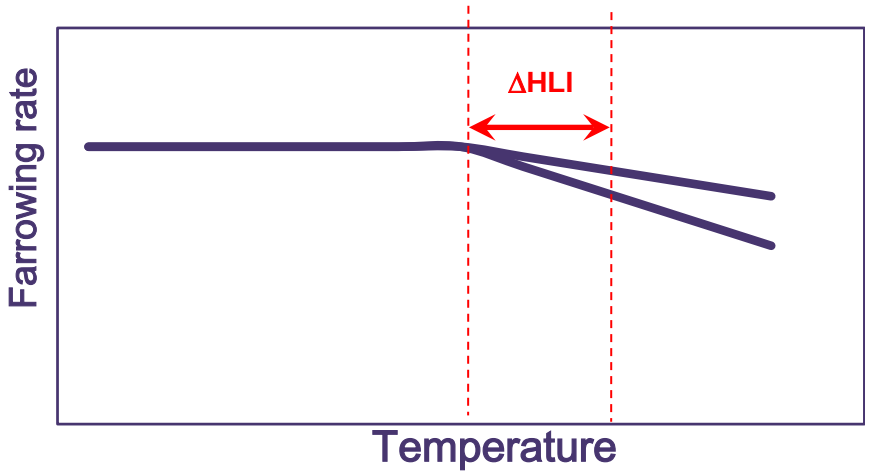
additive effect:
regular yield

additive effect:
heat tolerance

perm. env. effect:
regular yield

perm. env. effect:
heat tolerance

heat stress function:
f(i) = 0 below threshold
f(i) = ΔHLI above threshold

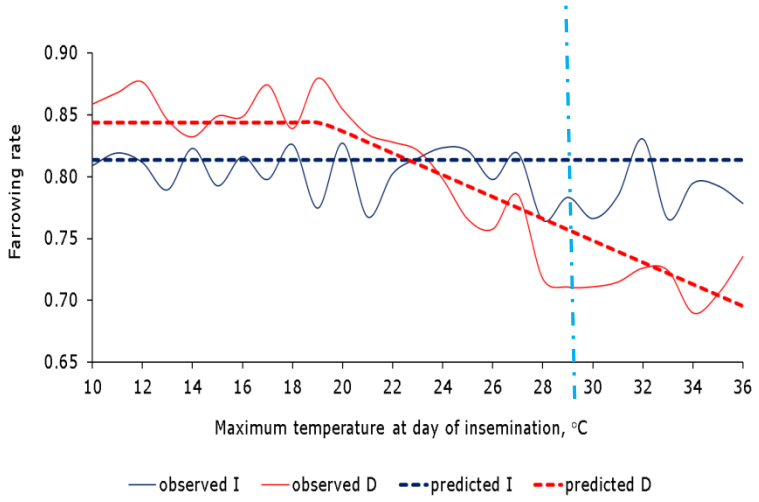



HLI = heat load index (Ravagnolo and Misztal, 2000)

# Genetic parameters (at 29.3ºC)

| Farrowing rate | D-line | I-line |
|---|---|---|
| $h^2$ level | $0.05_{0.02}$ | $0.08_{0.01}$ |
| $h^2$ slope | $0.04_{0.01}$ | $0.02_{0.01}$ |
| $r_g$ level, slope | $0.16_{0.37}$ | $-0.36_{0.17}$ |

1. More genetic variation for slope in the D-line than in the I-line
2. Genetic correlations of opposite sign, but inaccurate

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# Conclusion

1. The I-line is more adapted to managing high heat load than the D-line

2. There is genetic variation for response to temperatures above UCT, expressed in farrowing rate, in the D-line but less in the I-line

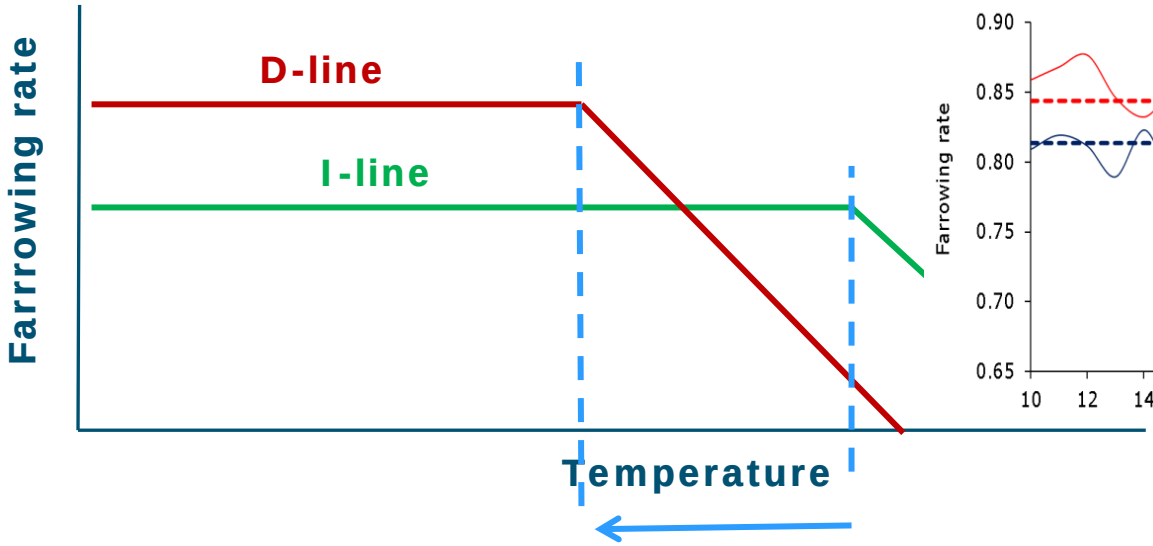
3. No clear evidence of genetic correlation between farrowing rate and sensitivity to high temperatures

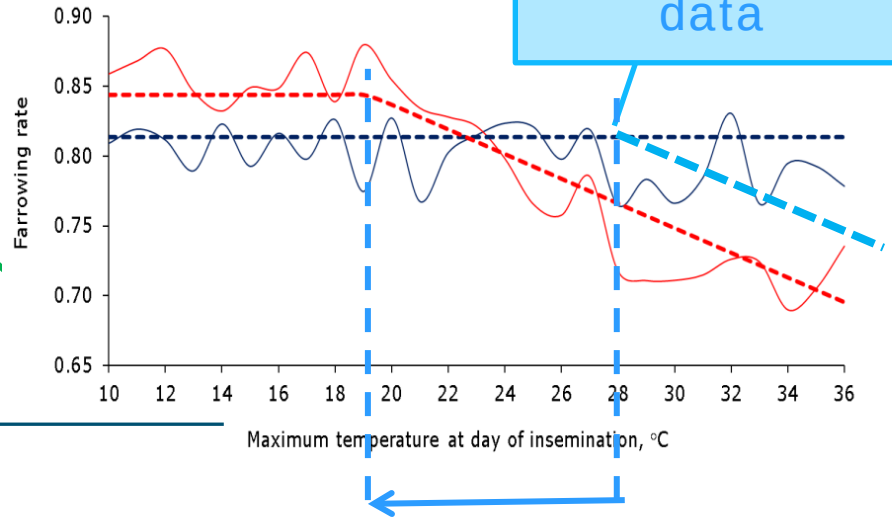
# Some remaining questions

- Where does the genetic variance for temperature sensitivity come from? Why is it larger in the D-line than in the I-line?
- Is the genetic correlation really 0 or do we need more data on high temperature performance?
- Is this model ok to analyse the I-line? Using UCT of the D-line may be suboptimal

# Hypothesis

- Assumption was: 19.2 $^{o}$C for D-line is UCT for both lines
- What if it is not only the slope, but also the start of the slope that indicate sensitivity and genetic correlation between farrowing rate and temperature sens
  negative:




Not estimable due to lack of data

Shift in start of slope

# Acknowledgement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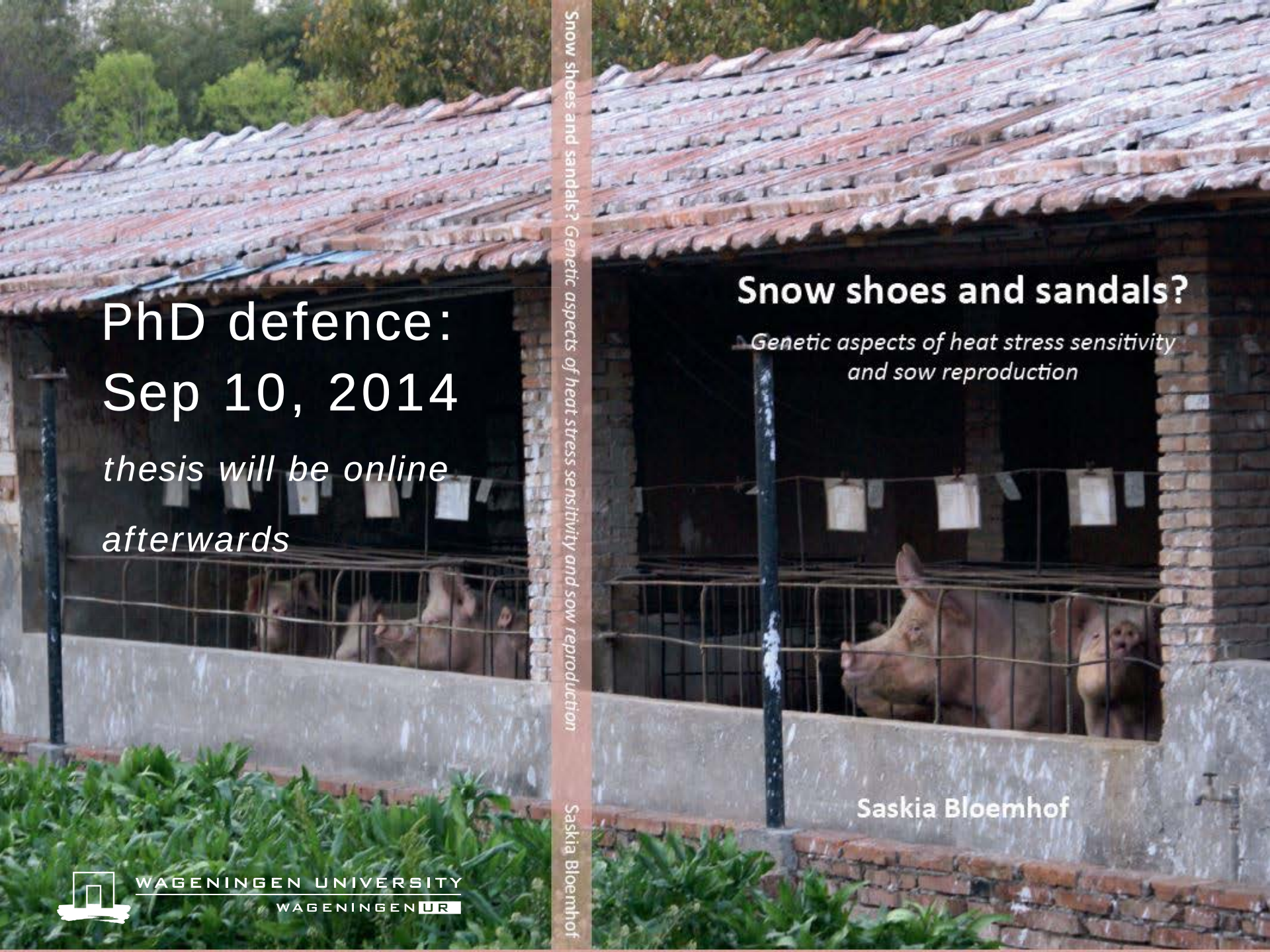
PhD defence:
Sep 10, 2014
thesis will be online
afterwards
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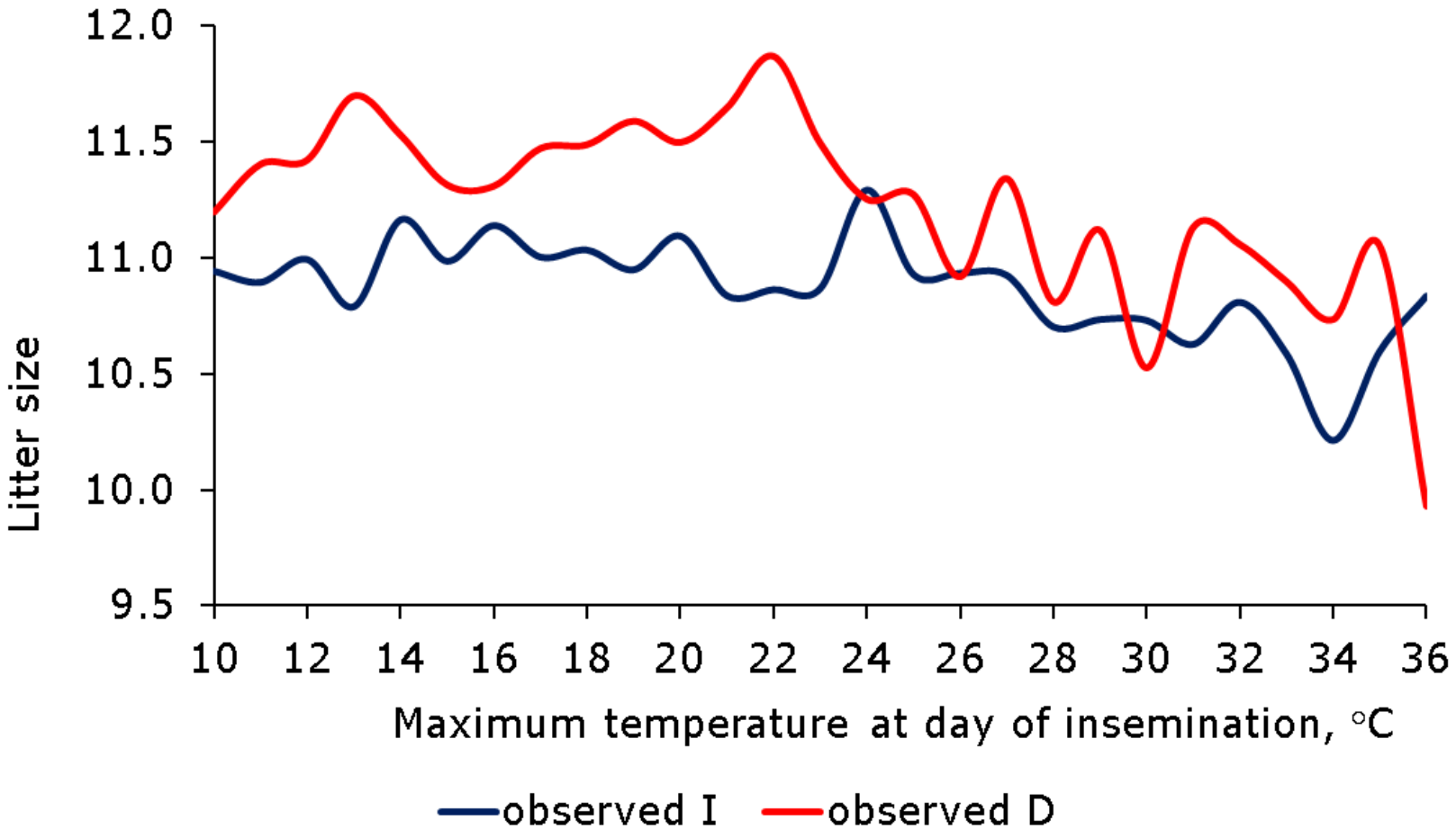
Snow shoes and sandals? Genetic aspects of heat stress sensitivity and sow reproduction Saskia Bloemhof
Snow shoes and sandals?
Genetic aspects of heat stress sensitivity and sow reproduction
Saskia Bloemhof

# Temperature at insemination and litter size

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Adapted from Bloemhof et al., 2008

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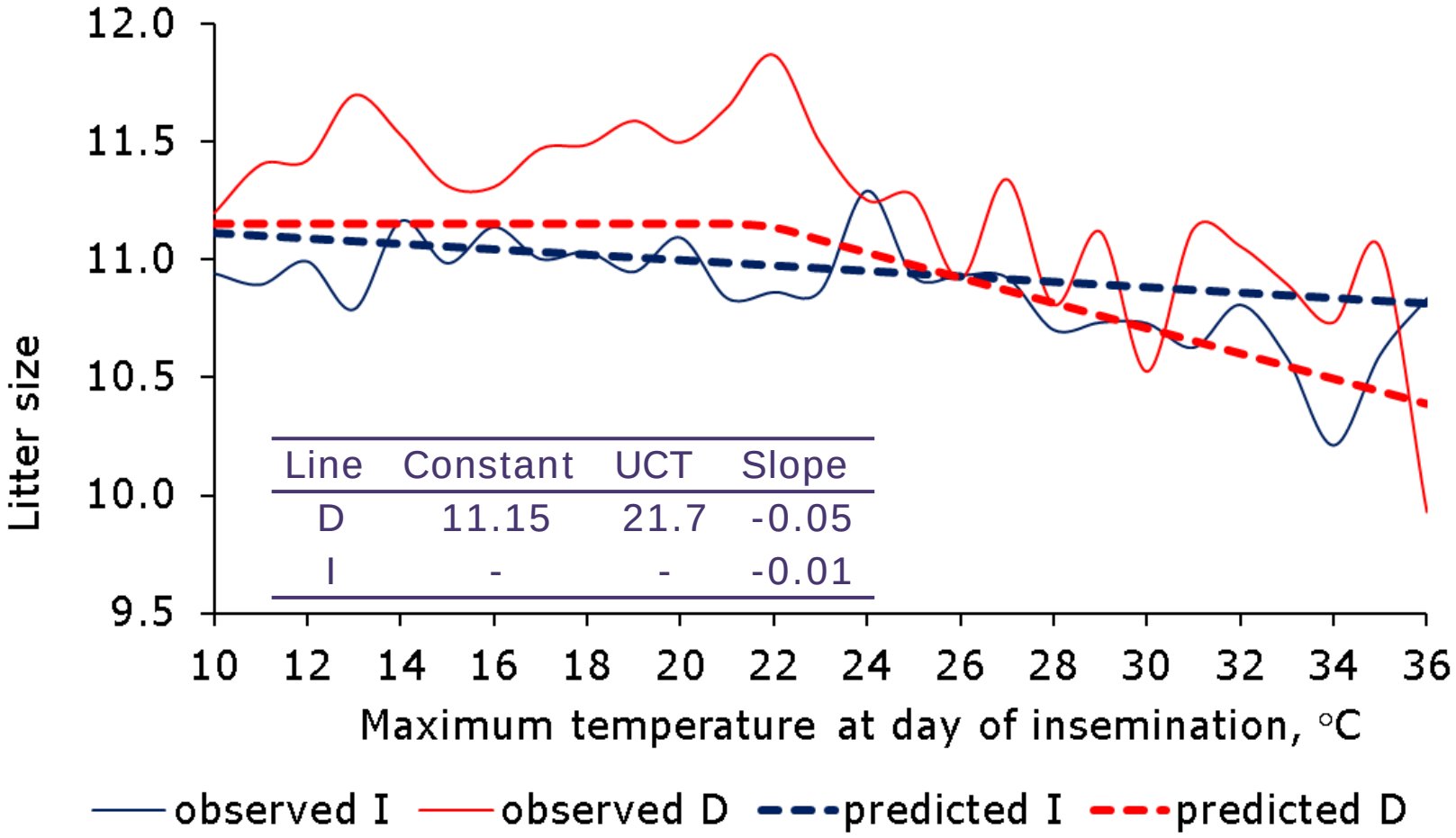


| Line | Constant | UCT | Slope |
|---|---|---|---|
| D | 11.15 | 21.7 | -0.05 |
| I | - | - | -0.01 |

Adapted from Bloemhof et al., 2008