GENETIC GAIN FOR PRODUCTION AND MATERNAL TRAITS IN A TWO-STAGE OPTIMUM CONTRIBUTION SELECTION SCHEME

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Dubrovnik,
30/8-2018

Miljø- og Fødevareministeriet
gudp

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HYPOTHESIS

1. A **two-stage** selection scheme with optimum contribution selection (OCS) at **both** stages realizes more genetic gain for both production and maternal traits
   when compared to a scheme with truncation selection in the initial and OCS in the final selection stage

2. OCS at pre-selection may be more important for lowly heritable traits that are more dependent on family information

PROBLEM

- Preselection by truncation may favour production above maternal traits in the selection index
- Genetic gain in the breeding goal may be less than optimal for a non-integrated market

- Maternal traits are typically measured late in life, have low heritabilities, and are negatively correlated to production traits

  → breeding value accuracies are higher for production traits at early selection steps

SIMULATION STUDY

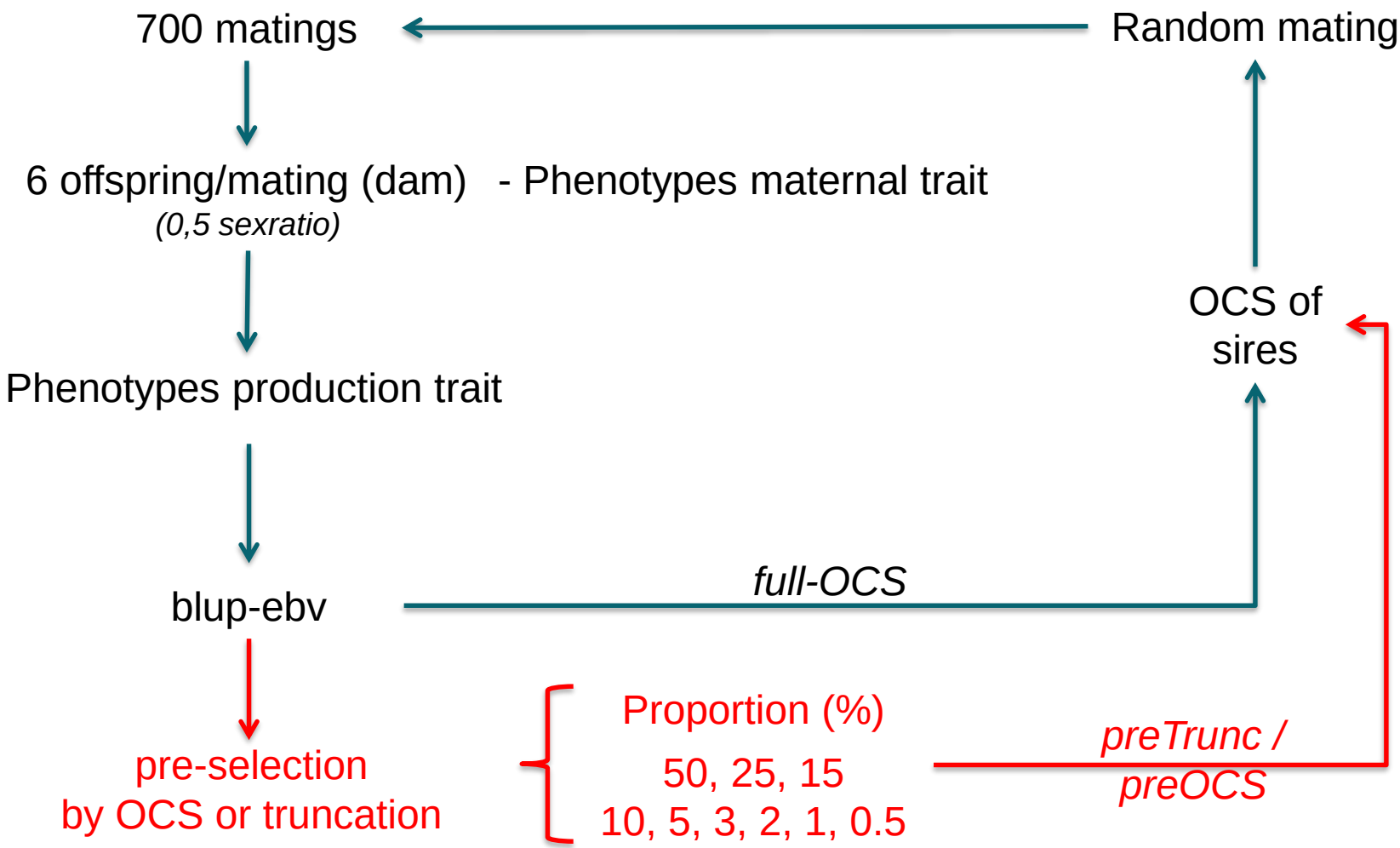
- *full-OCS*: reference selection scheme *without* pre-selection.
  - Sires are selected by OCS
  - Dams are truncation selected

- Alternative selection schemes *with* pre-selection of sires:
  - *preTrunc*: pre-selection by truncation
  - *preOCS: pre-selection by OCS*

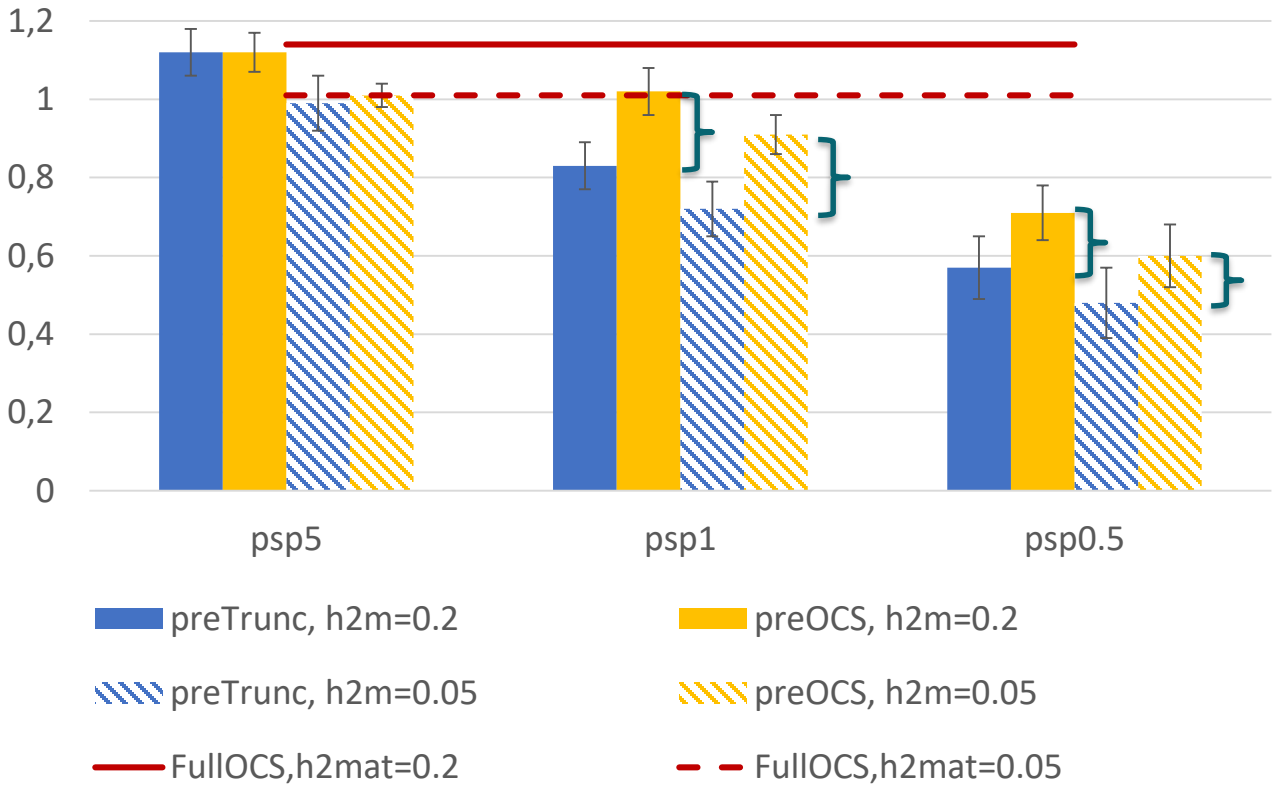
SIMULATION STUDY

- Two traits:
  a production trait: $h^2_{prod} = 0.20$
  a maternal trait: $h^2_{mat} = 0.20\ or\ 0.05$
  $r_g = 0.00\ (0.50, or\ -0.50)$
  $v_{prod} = v_{mat} = 1$

- Results:
  long-term ΔG: ~23 to ~25th generation
  Average of 50 repetitions
  ΔF kept at ~1% in all scenarios


700 matings
Random mating
6 offspring/mating (dam)
- Phenotypes maternal trait
(0,5 sexratio)
Phenotypes production trait
OCS of sires
blup-ebv
full-OCS
pre-selection by OCS or truncation
Proportion (%)
50, 25, 15
10, 5, 3, 2, 1, 0.5
preTrunc / preOCS

HIGHER AGGREGATE ΔG WITH OCS THAN TRUNCATION FOR LOW PRE-SELECTED PROPORTION



Any effect of the $h^2(mat)$?

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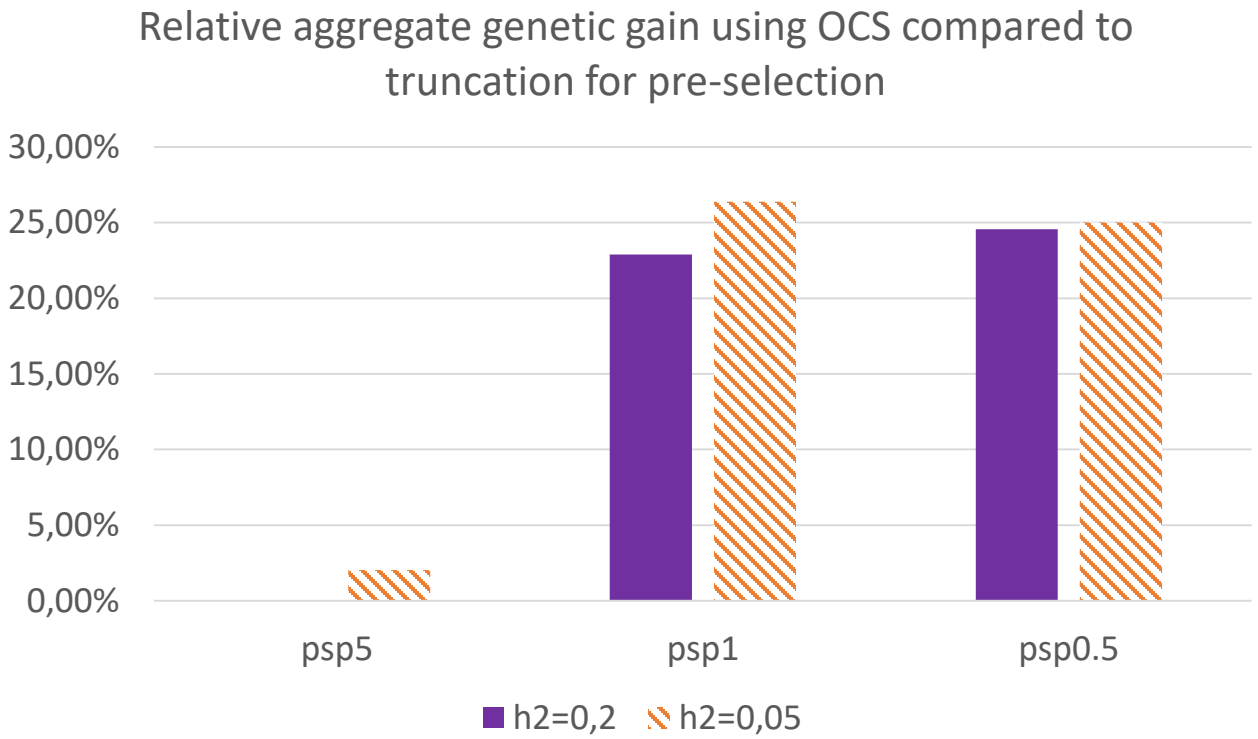
HERITABILITY OF MATERNAL TRAIT ONLY A VERY SMALL RELATIVE SCALE EFFECT



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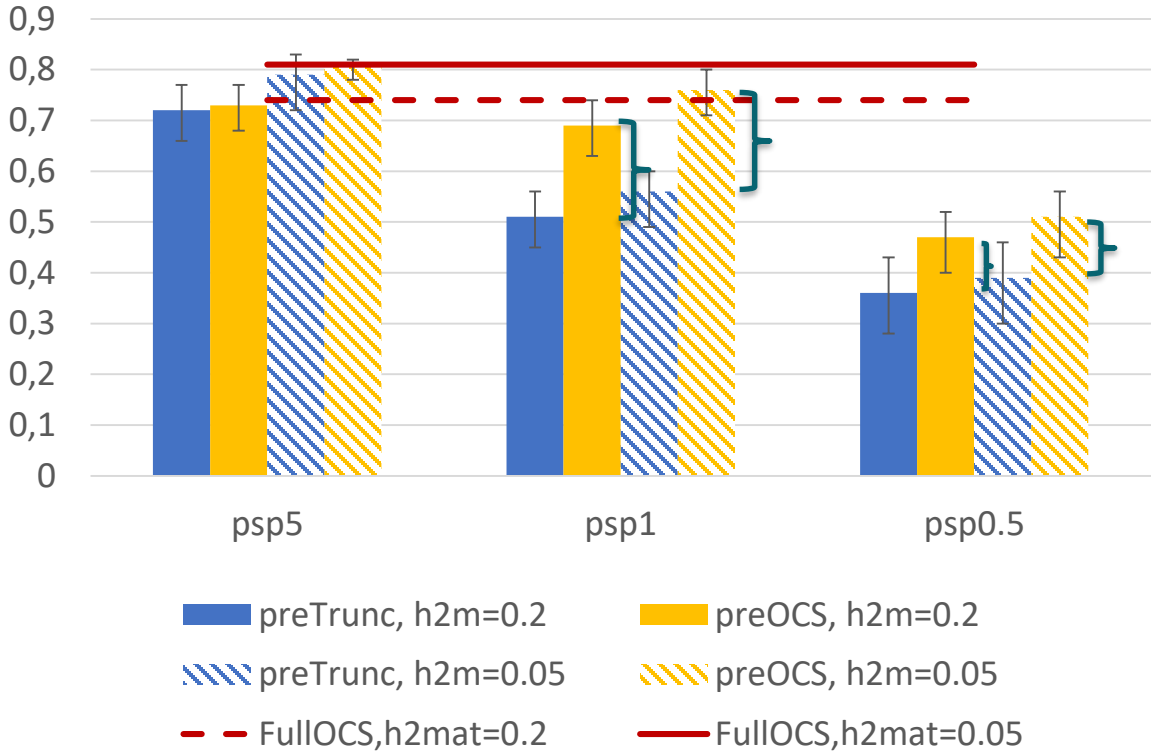
HIGHER ΔG IN PRODUCTION TRAIT WITH OCS THAN TRUNCATION FOR LOW PRE-SELECTED PROPORTION



Any effect of $h^2(mat)$?

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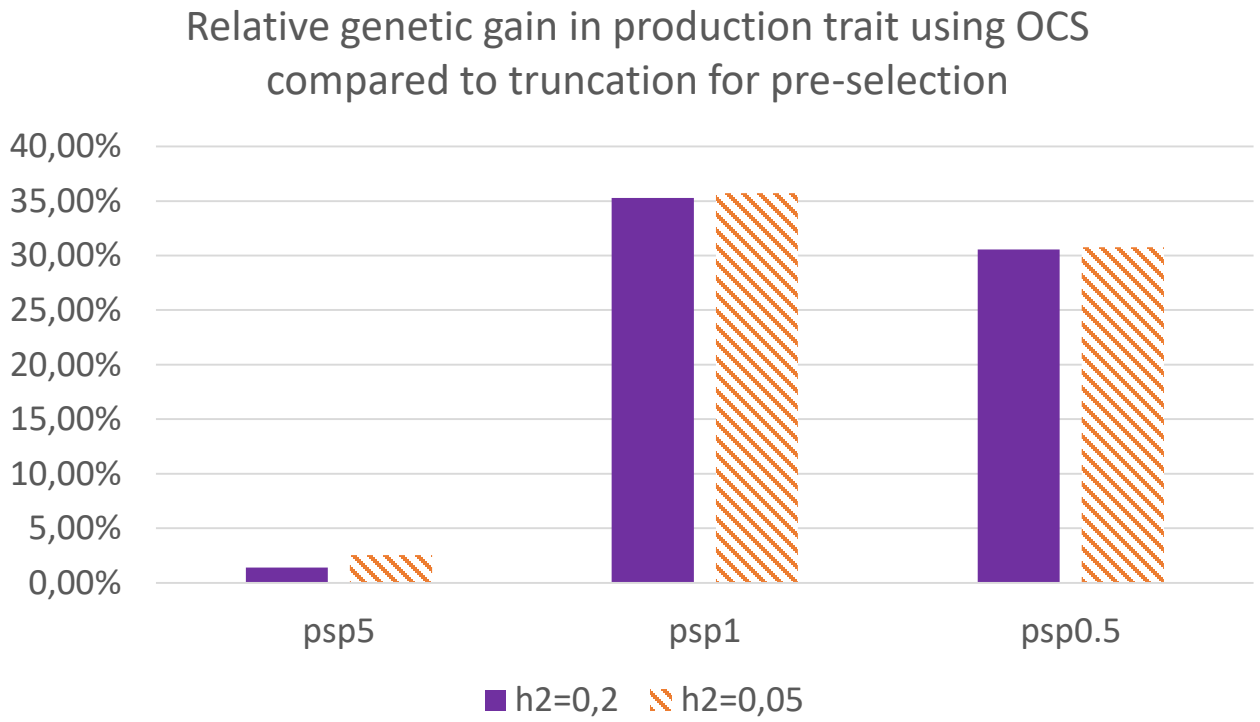
NO EFFECT OF HERITABILITY OF MATERNAL TRAIT



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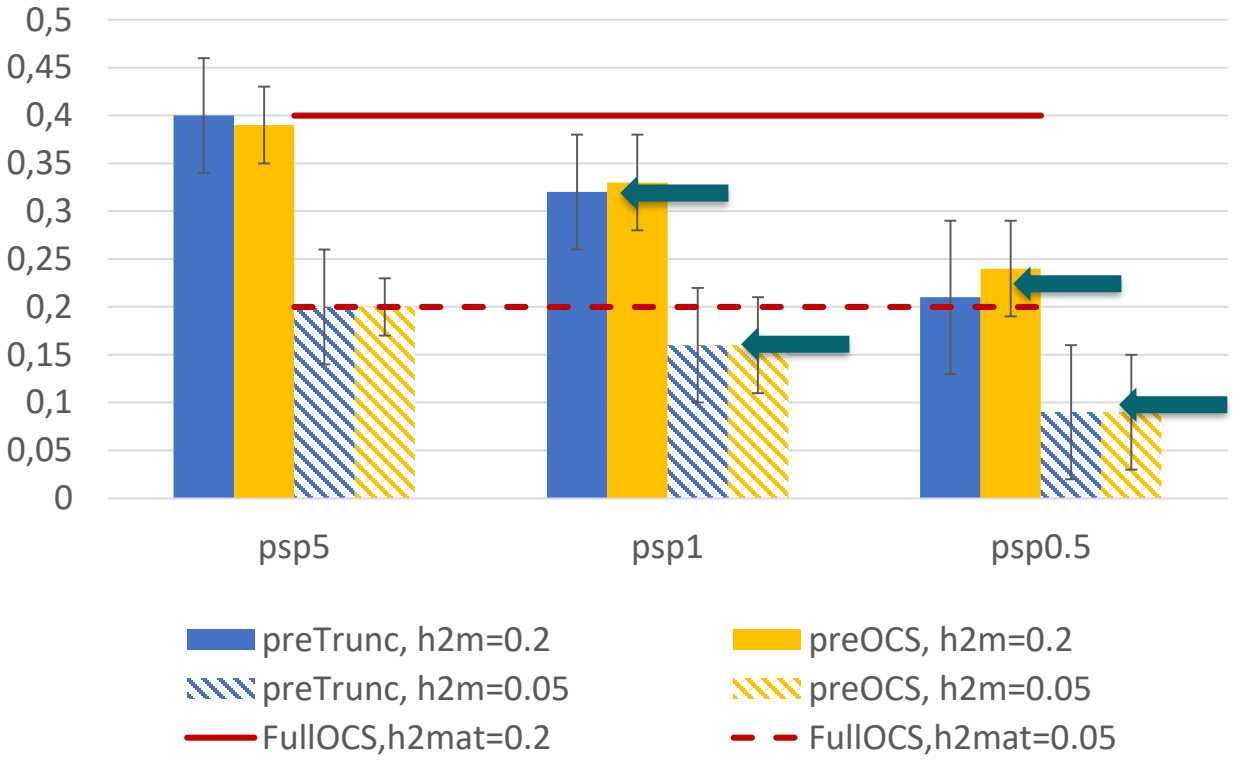
NO DIFFERENCE IN ∆G IN MATERNAL TRAIT BETWEEN USING TRUNCATION OR OCS FOR PRE-SELECTION



No effect of $h^2(mat)$!

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OCS IN PRE-SELECTION CHANGES COMPOSITION OF AGGREGATE GENETIC GAIN:

- A higher degree of genetic gain in the production traits
- No loss in the maternal traits → no trade-off!
- No effect of the heritability of the maternal trait on this result!

WHY IS PRE-SELECTION BY OCS AN ADVANTAGE FOR THE PRODUCTION BUT NOT THE MATERNAL TRAIT?

- Within versus between family selection?
  - OCS favours within family selection to reduce ΔF?
  - Timing of phenotypic information / accuracy of traits at time of selection
- Overlapping generations → more effect on $\Delta G(mat)$?
- Low-accuracy production type traits, e.g. pooled records or social genetic traits → more effect on ΔG?

CONCLUSION

- **Two-stage** selection scheme with optimum contribution selection (OCS) at **both** stages **DOES** realize more genetic gain for production traits, but NOT for maternal traits

- No effect of heritability on the effect of pre-selection by OCS on maternal trait genetic gain

→ At the same inbreeding rate, preselection by **OCS** favours high accuracy traits, but **without** losses in low-accuracy traits