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Estimation of dominance variance with sire-dam subclass effects in a crossbred population of pigs

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Background

❖Nonadditive genetic effects (e.g. dominance) not negligible but often ignored in genetic evaluations
❖Dominance = interaction of paternal and maternal alleles at the same locus
❖Prediction of dominance effects ➔ More precise estimation of totale genetic merit
➔ Beneficial for mate selection programs
❖ Inversion of dominance relationship matrix (D^{-1}) difficult with large dataset
❖ D^{-1} can be deduced from F^{-1}, the inverted sire-dam subclasses relationship matrix

Objective

To estimate dominance variance for longitudinal measurements of body weight in a crossbred population of pigs

Conclusions

❖ Dominance variance exists for growth traits in pigs and may be relatively large
❖ Additive genetic variance slightly decreases when dominance is added in the model

Data

❖ Recorded in test station between 2007 and 2012 on crossbred pigs (Piétrain x Landrace K+)
❖ 20,120 records of body weight between 50 and 210 days of age from 2,341 different pigs
❖ 89 Piétrain boars and 169 Landrace K+ sows
❖ Standardization and pre-adjustment of data at 210 days due to variance heterogeneity

Model

Random regression animal model with linear splines (knots at 50, 100, 175, and 210 days)

❖ Model 1: additive

$$y = Xb + Q(Za + Zp) + e$$

❖ Model 2 : additive + dominance

$$y = Xb + Q(Za + Wf + Zp) + e$$

with $Var(f) = I\sigma_f^2$

❖ Model 3 : additive + dominance

$$y = Xb + Q(Za + Wf + Zp) + e$$

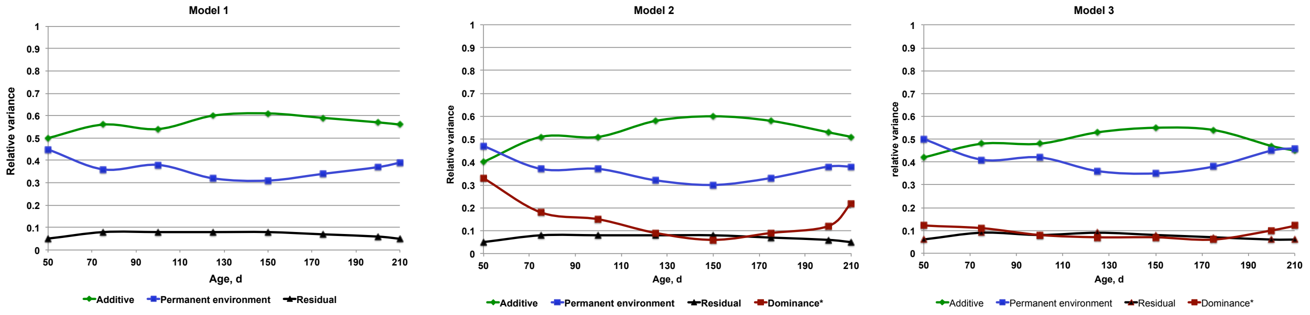
with $Var(f) = F\sigma_f^2$

F = sire-dam subclasses relationship matrix

y=observations; b=fixed effects (sex, day of test, and heterosis); a=random additive genetic effect; p=random permanent environment; f=random parental dominance; e=residual; X, Z, W=incidence matrices; Q=matrix of linear splines coefficients

Results

Relative variance components for body weight between 50 and 210 days (*$\sigma_d^2=4\sigma_f^2$)



❖ h^2 varies between 0.50 and 0.60 and slightly increases with age

❖ h^2 varies between 0.40 and 0.60
❖ Dominance variance represents:
  - ✓ 10 to 83% of additive variance
  - ✓ 6 to 30% of total variance

❖ h^2 varies between 0.42 and 0.55
❖ Dominance variance represents:
  - ✓ 11 to 30% of additive variance
  - ✓ 7 to 9% of total variance

h^2 slightly decreases when dominance effect is added in the model (Model 1 vs. Model 2 and 3)

Changes in variance estimates are small between model 2 and 3, except at the beginning and at the end ➔ Border effect?

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