

Genetic (co)variances of Gompertz growth function parameters in pigs

J.M. Coyne^{1,2,3}, K. Matilainen², M-L. Sevon-Aimonen², D.P. Berry¹,
E. A. Mäntysaari², J. Juga³, T. Serenius⁴, and N. McHugh¹

¹Teagasc Moorepark, Cork, Ireland

²Dept. of Agricultural Sciences, University of Helsinki, Finland

³Biometrical Genetics Dept., LUKE Agrifood Research, Finland

⁴Figen Ltd., Seinäjoki, Finland



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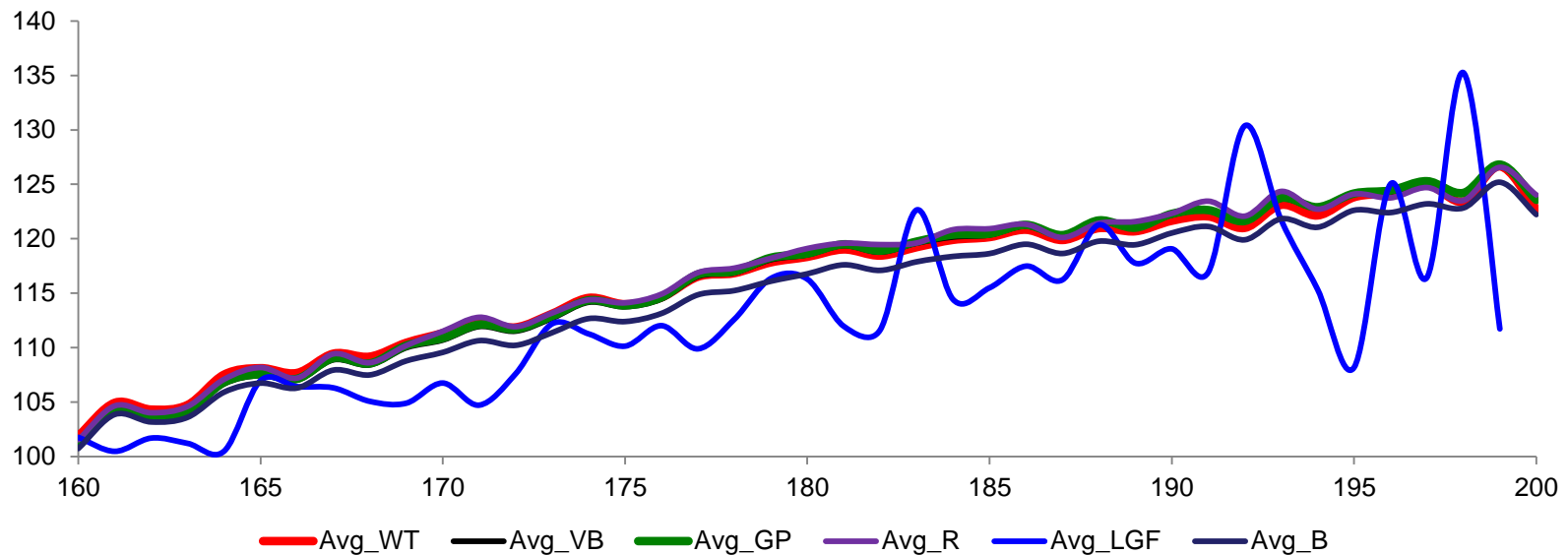
Comparison of fixed effects and mixed model growth functions in modelling and predicting live weight in pigs

J.M. Coyne^{a, b, c}, D.P. Berry^a, E.A. Mäntysaari^b, J. Juga^c, N. McHugh^a  

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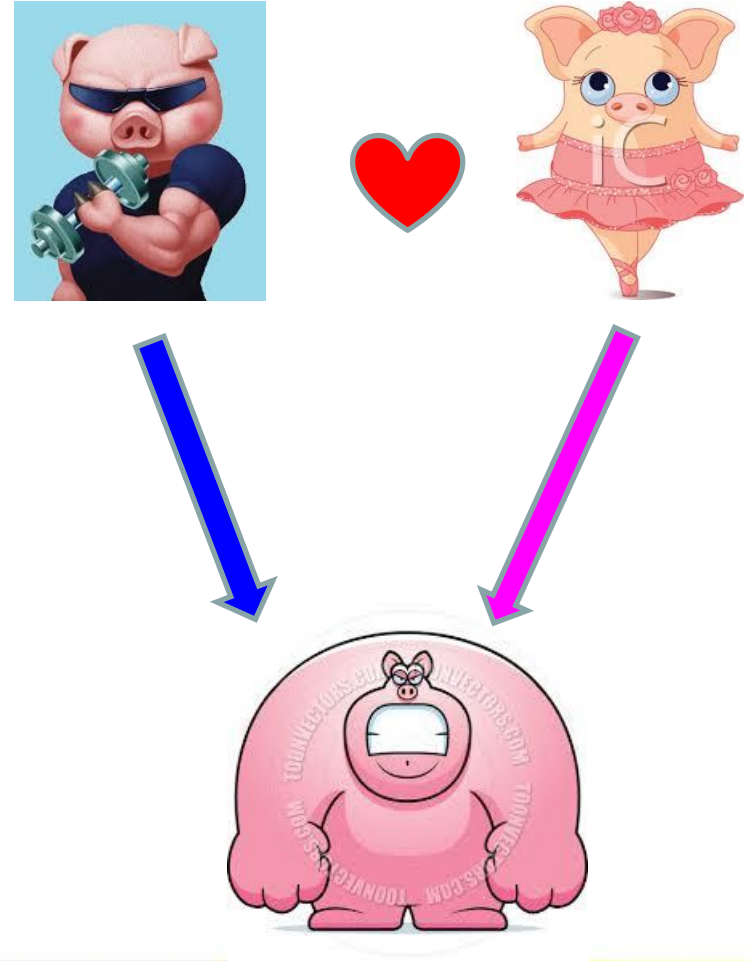
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Motivation

- Estimate genetic merit
- Calculate heritability (h^2)
- Provide breeding values (PTAs)
- Select for faster growth rates



Objective

- Estimate the genetic (co)variance of the Gompertz growth function parameters



Data

- Pig live weight data
- Finnish company – Figen Oy
- Included in national evaluations
- Weighed every 2 weeks



Materials and methods

- 90,131 live-weight records on 18,098 pigs
- 2006 and 2013, inclusive
- Edits:
 - 5 weight records
 - Alive
 - Healthy
- Final 51,893 live weight observations from 10,201 animals



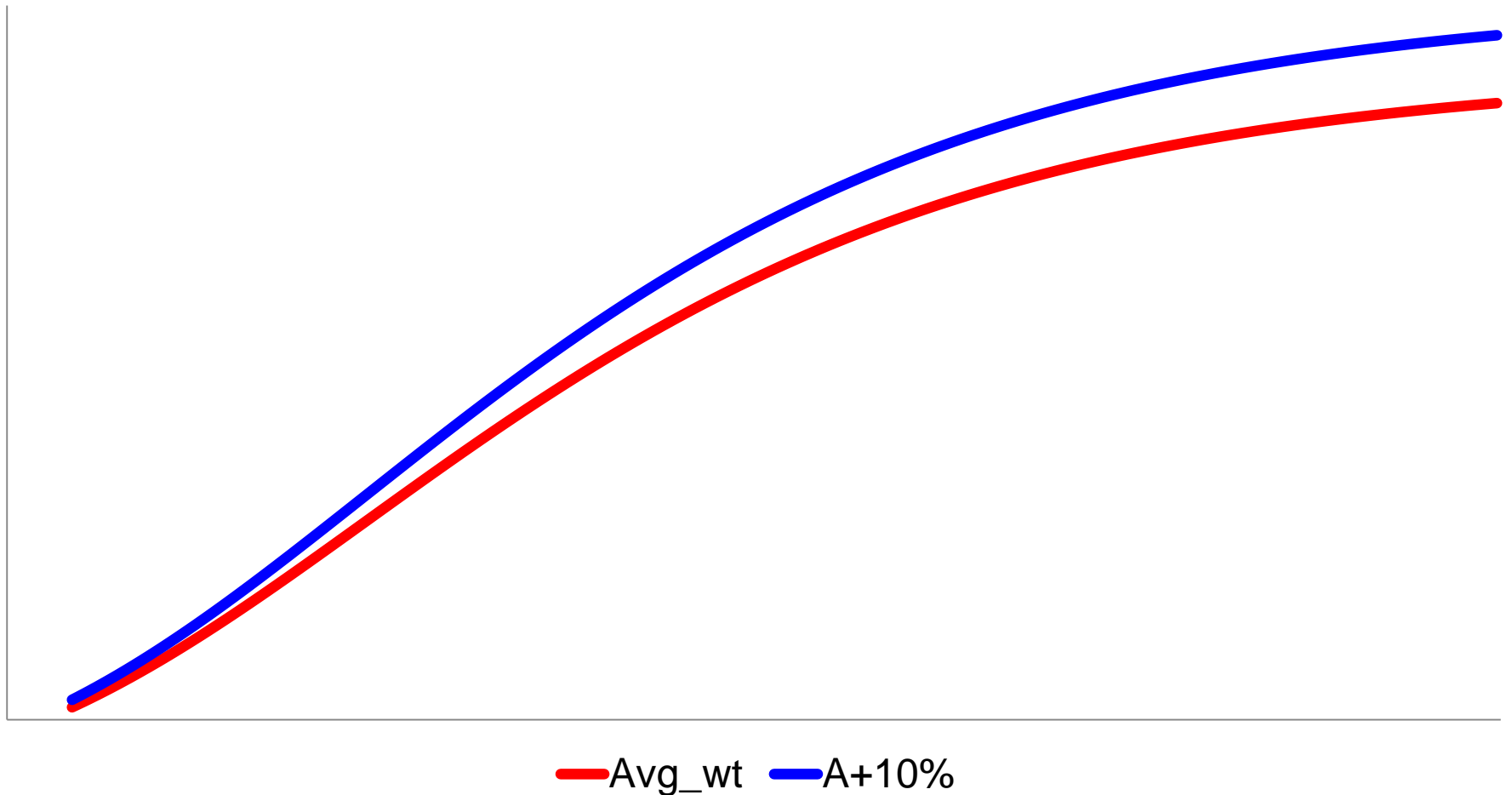
Materials and methods

- Gompertz function;

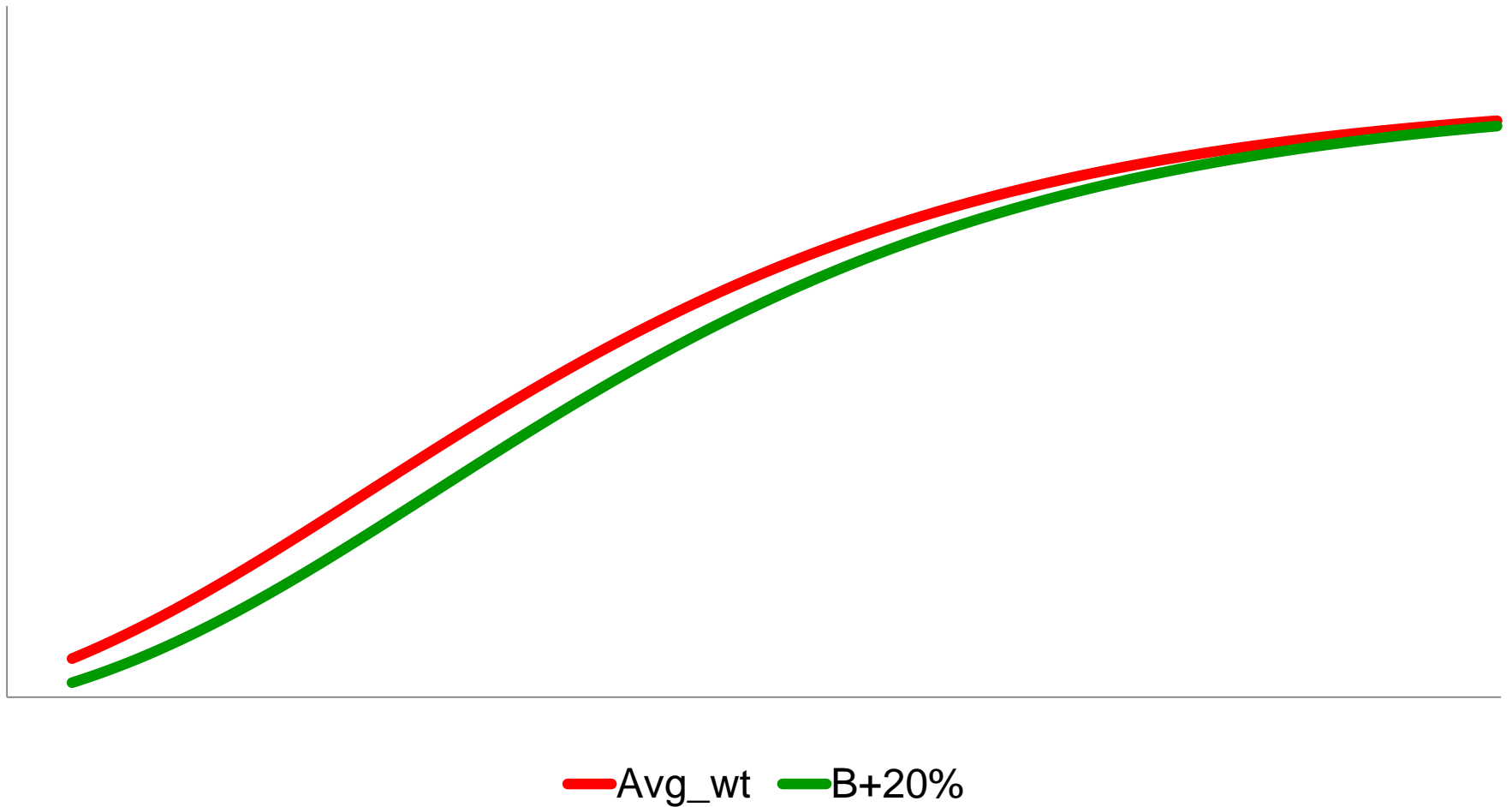
$$\ln(Y_t) = \ln(A) * (-B \exp^{-kt}) + \ln(e)$$

- A : asymptotic mature weight;
- B : ratio of birth weight to mature weight;
- k : rate of maturation

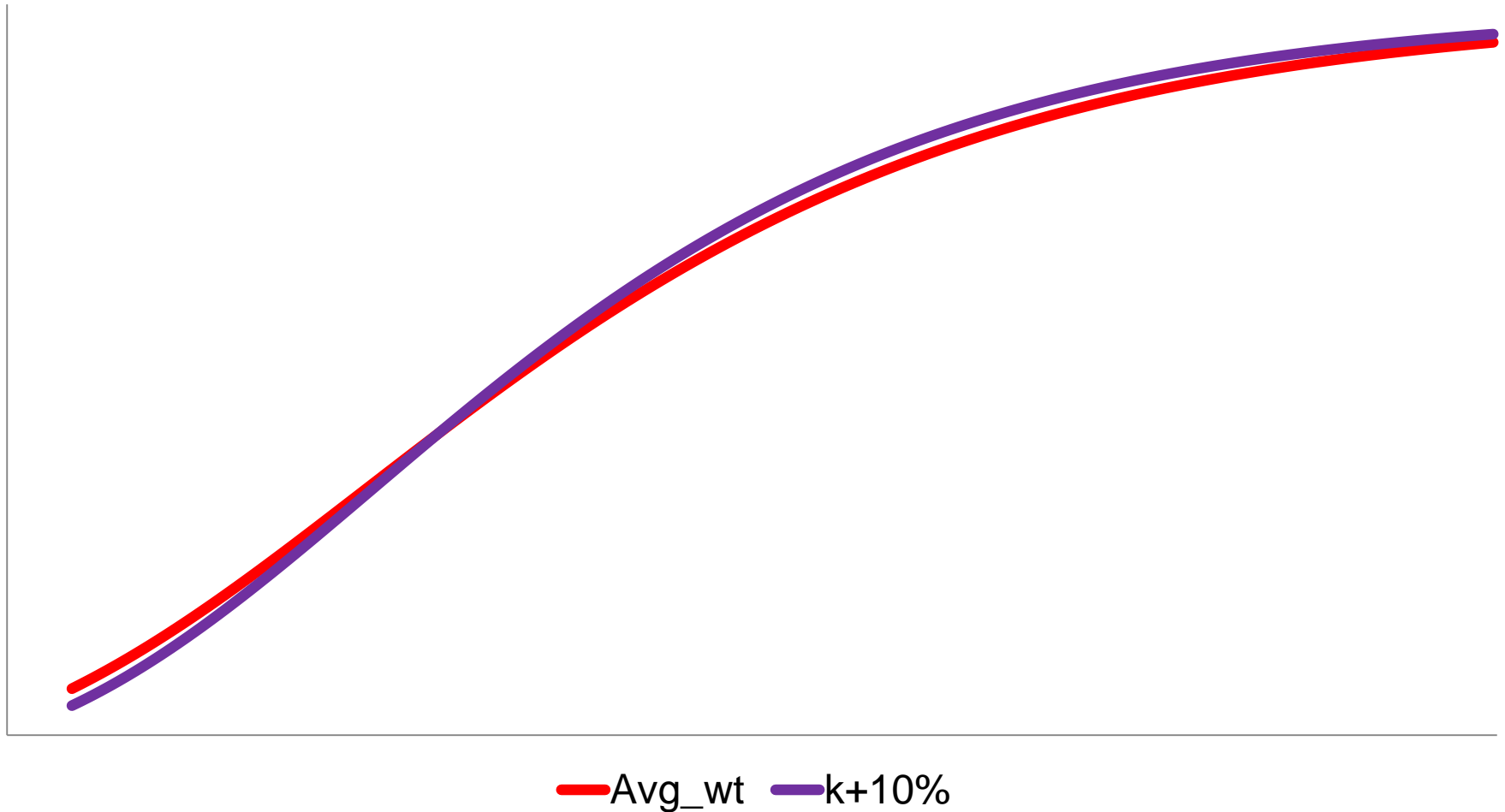
Materials and methods



Materials and methods



Materials and methods



Materials and methods

- Gompertz function;

$$\ln(Y_t) = \ln(A) * (-B \exp^{-kt}) + \ln(e)$$

- A : asymptotic mature weight;
 - B : ratio of birth weight to mature weight;
 - k : rate of maturation
- Mixed model equation:
 - Fixed effects; contemporary group (start date) and gender
 - Random effects; litter, animal and sire genetic effect

Materials and methods

- Mix99 and DMU
- Iterative process:
 - Mix99 – parameter estimates generated
 - DMU – EM-REML to obtain variance components
 - Convergence criteria of < 0.0001
- Genetic variances obtained for each parameter
- Heritabilities estimated



Materials and methods

- Variance components converted (Koivula et al., 2008):

$$\sigma_a^2 = 4\sigma_{sire}^2$$

$$\sigma_c^2 \cong \sigma_{litter}^2 - \sigma_{sire}^2$$

$$\sigma_{pe}^2 = \sigma_{animal}^2 - 2\sigma_{sire}^2$$

- Heritability estimates:

$$h^2 = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_c^2 + \sigma_{pe}^2}$$

Results




Variance estimates and heritability estimates for Gompertz growth function

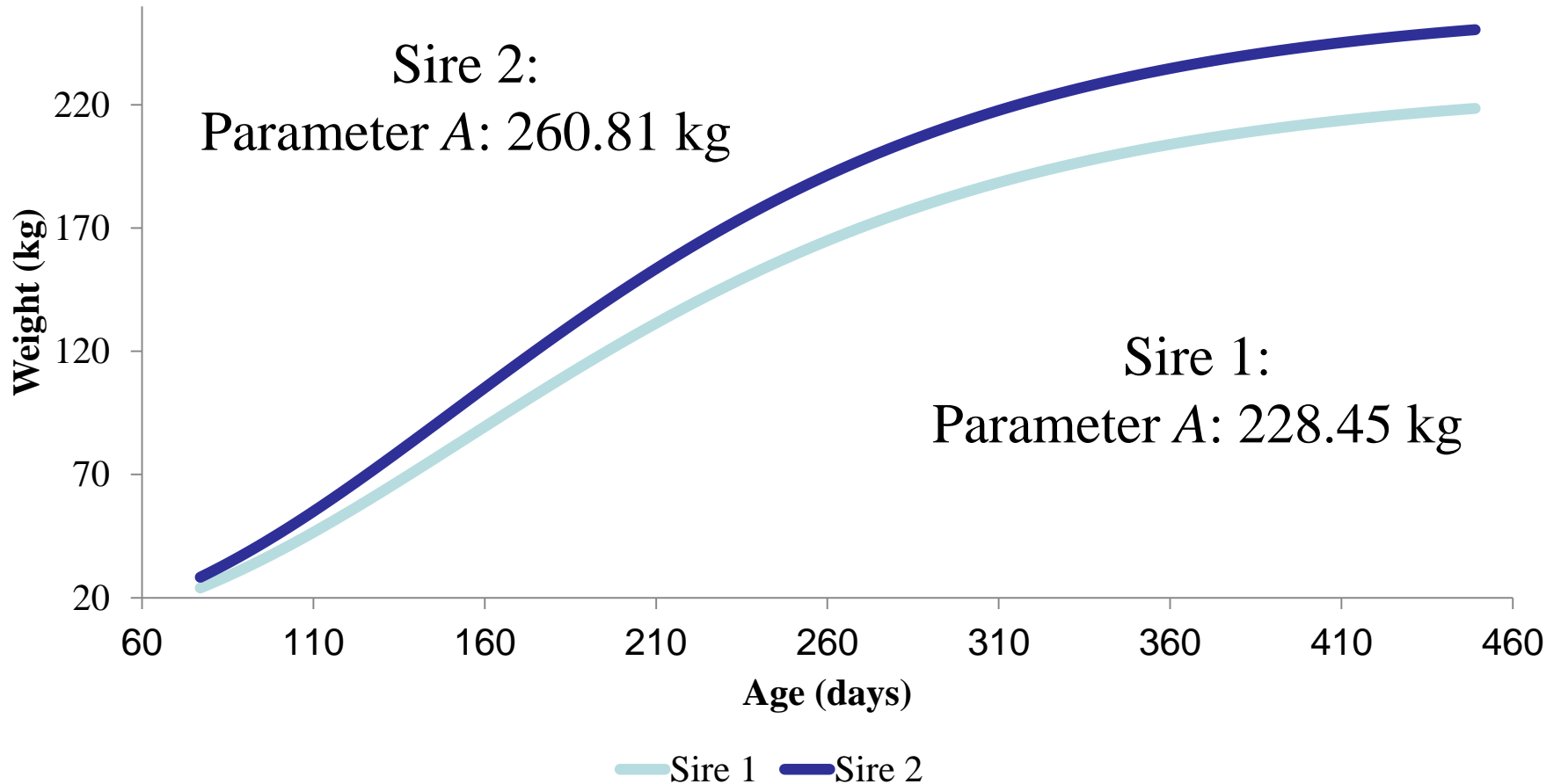
Parameter	Variances			h^2
	Sire	Litter	Animal	
Asymptotic mature weight (A)	165.6345	149.0610	1343.3850	0.40
Ratio of birth weight to A (B)	0.0199	0.0707	0.0252	0.69
Rate of maturation (k)	0.0001	0.0007	0.0003	0.45

Correlations

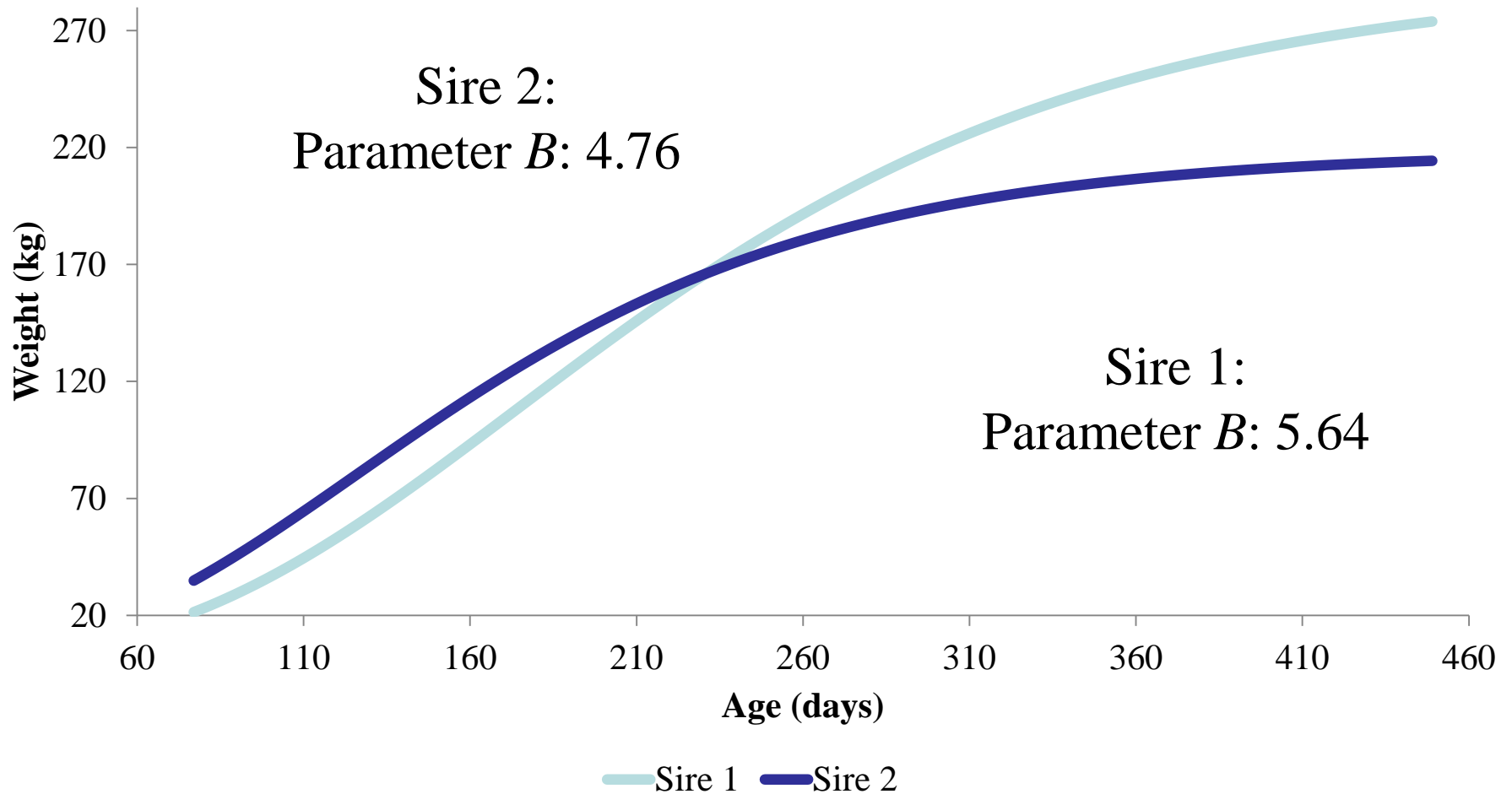
Parameter	<i>A</i>	<i>B</i>	<i>k</i>
<i>A</i>	1		
<i>B</i>	-0.39	1	
<i>k</i>	-0.15	-0.07	1

A cartoon illustration of a pink pig wearing a black graduation cap and gown, with its arms raised in a celebratory gesture. The pig has large eyes and a wide smile.

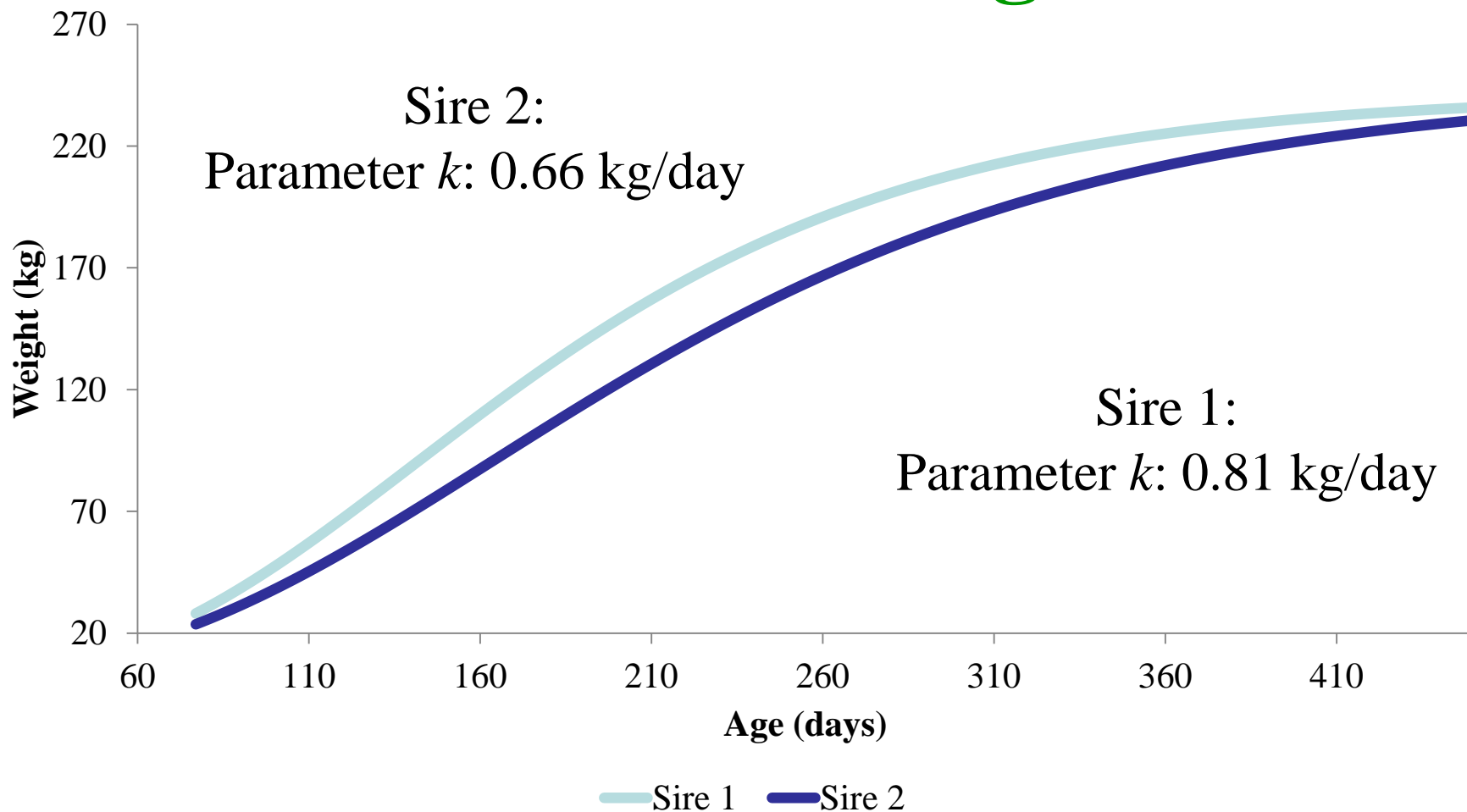
Estimated breeding values



Estimated breeding values



Estimated breeding values



Conclusion

- Ample genetic variation exists in parameters A , B and k of the Gompertz function
- Possibility to alter the shape of the animals growth curve





Questions?