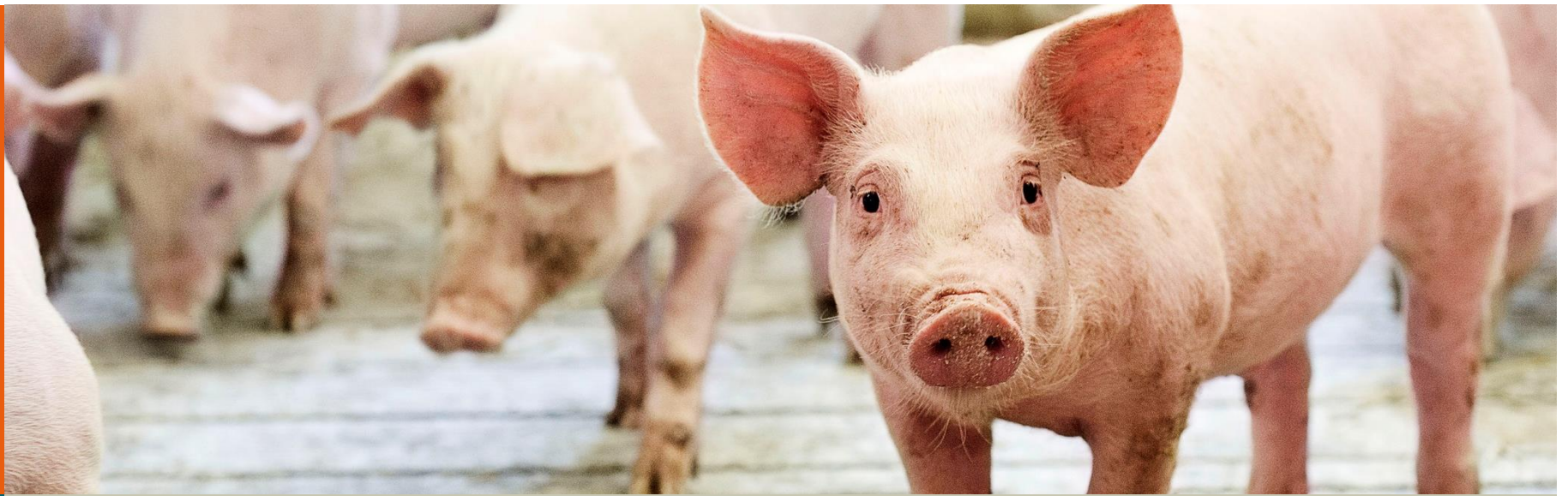




Breeding for Social Interactions

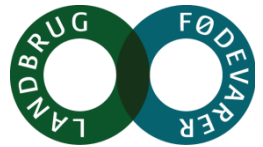


Videncenter for
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I want to show you that:

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- there seems to be social-genetic variation for growth
- **BUT: problems with data/model!**
- Prediction is difficult!
- Genetic gain is lower than expected

Bøgildgård:

- Duroc, ADG, byear 2009-2013,
- 852 groups, 10884 ids, group size: 10-14,
- $\bar{a}_{group}$: 0.10

All herds (including Bøgildgård):

- DD / YY / LL
- Groups from March to November 2014
- Records: DD: 16,000 / YY: 28,000 / LL: 22,000
- $\bar{a}_{group}$: ~0.2

Simulated:

- Same pedigree and group structure as Duroc (all herds)
- New phenotypes with only random effects

- A classical animal model

$$Y = Xb + Zg + Za + e$$

- A social-genetic model

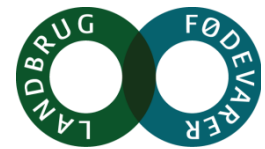
$$Y = Xb + Zg + Za_d + \sum Za_s + e$$

- A social-genetic model with social environment

$$Y = Xb + Zg_d + Za_d + \sum Za_s + \sum Zg_s + e$$

Definitions of breeding values and corrected phenotypes

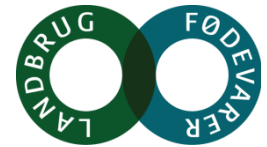
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- Trait value: $P_i = A_{D,i} + E_{D,i} + \sum_{j \neq i}^n A_{S,j} + \sum_{j \neq i}^n E_{S,j}$
- Total breeding value: $TBV(A_T) = A_D + (n - 1)A_S$
- Heritability: $T^2 = \frac{var(A_T)}{var(P)}$
- Corrected phenotypes:
 - $\hat{P}_{i,cl} = \hat{a}_{i,cl} + \hat{e}_{i,cl}$
 - $\hat{P}_{i,d,soc} = \hat{a}_{i,d,soc} + \widehat{grp}_{i,soc} + \hat{e}_{i,soc}$
 - $\hat{P}_{i,ds,soc} = \hat{a}_{i,d,soc} + \sum \hat{a}_{j,s,soc} + \widehat{grp}_{i,soc} + \hat{e}_{i,soc}$

Genetic parameters, data

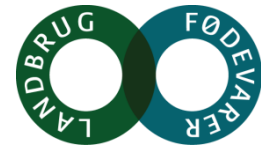
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	August, Bøgildgård			November, Bøgildgård	
Model	Classical	Social	Model	Classical	Social
var(Ad)	3381	3492	var(Ad)	2448	2599
cov(Ads)		234	cov(Ads)		127
var(As)		66	var(As)		28
var(grp)	1459	217	var(grp)	748	199
var(litter)	-	-	var(litter)	776	763
residual	5855	6047	residual	5635	5701

Genetic parameters, data

Videncenter for
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	DD, all		YY, All		LL, All	
Model	Classical	Social	Classical	Social	Classical	Social
var(Ad)	1073	1086	2265	2260	1920	1936
cov(Ads)		27		-12		2
var(As)		18		10		9
var(grp)	1248	1005	783	684	908	813
var(litter)	515	516	459	453	704	701
residual	7295	7308	5672	5657	5969	5958

- **Outliers:**
 - individual and group level
 - Additive genetic relationship (within groups)
- **Confounding environmental effects**
 - Effect combinations with too few numbers
 - Fixed vs. Random effects
 - Combinations of fixed effects and covariables?
- **Variable groupsize?**
 - Only one group size
 - Dummy animals to equalize group sizes
- **Social environmental effects / correlated residuals?**
- **Simply too low additive genetic relationship within group?**

Genetic parameters, simulation

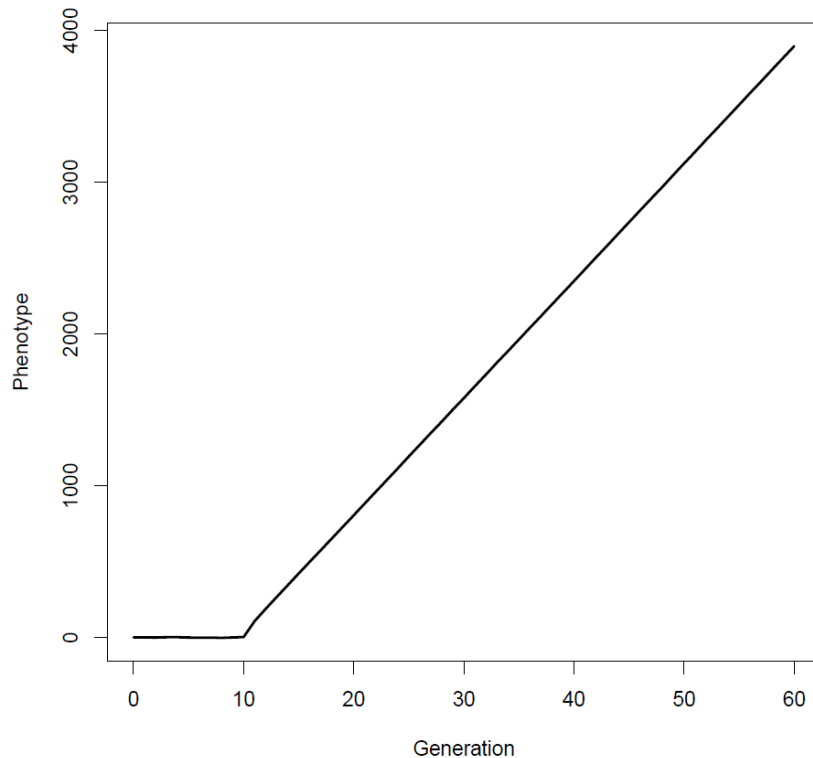
Simulation center for
various production



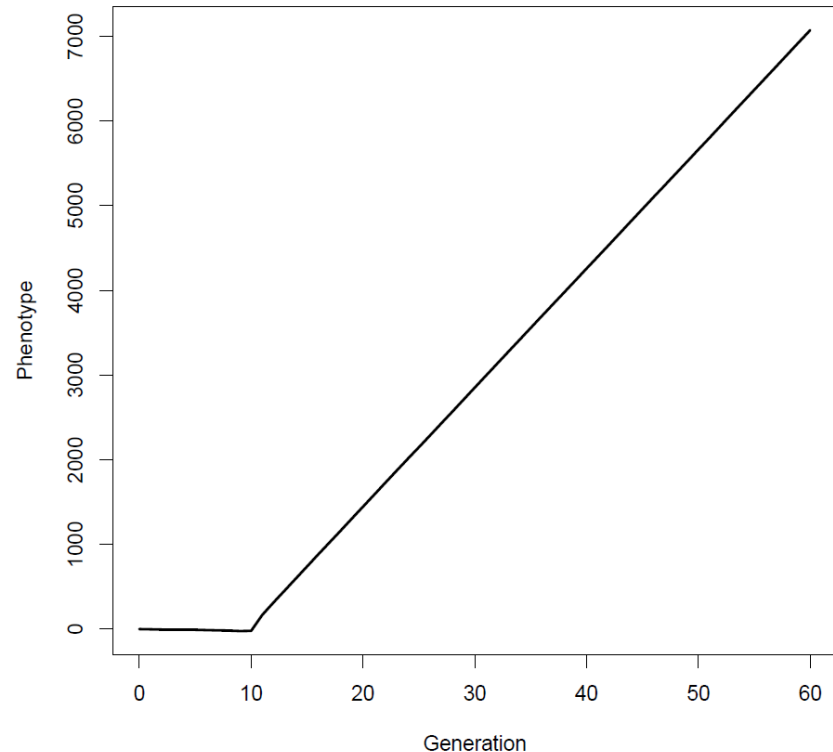
	Simulated					
True	Input		Classical		Social	
Model	Classical	Social	Classical	Social	Classical	Social
var(Ad)	2986	2986	3021	2954	1769	2972
cov(Ads)		116		28		3012
var(As)		36		0.26		3058
var(grp)	157	157	233	191	63705	0.12
residual	6140	6140	6107	6180	5127	6162

Simulations – Selection on true total genetic value – dP (classical vs. social)

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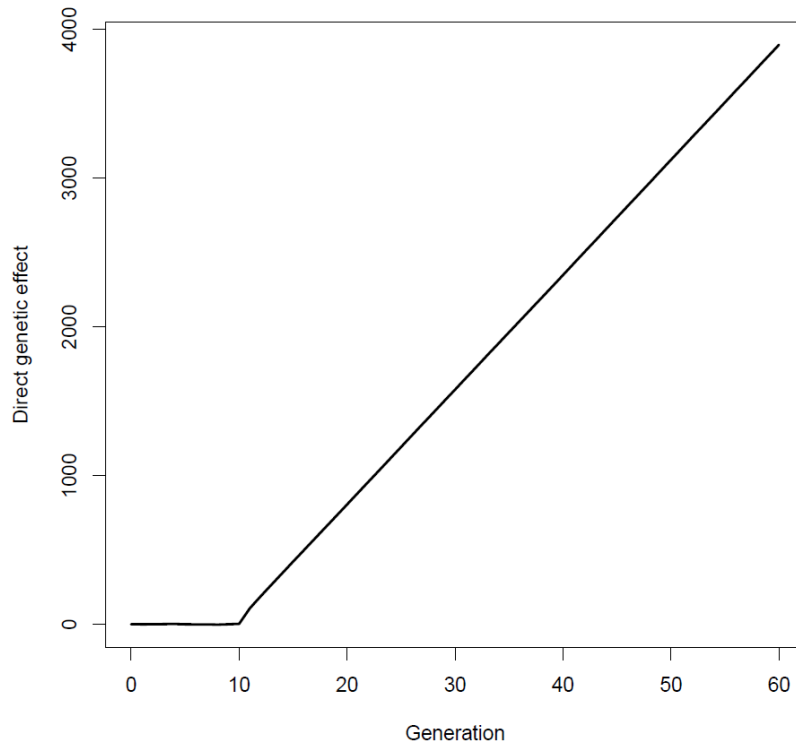
True classical model



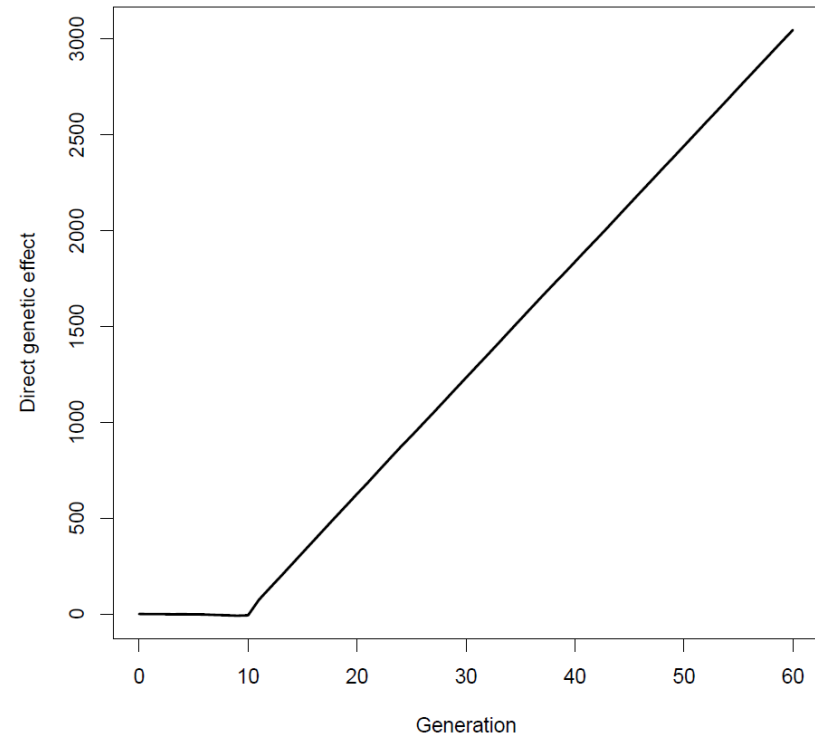
True social-genetic model

Simulations – Selection on true total genetic value – dG(direct)

Videncenter for
Svineproduktion



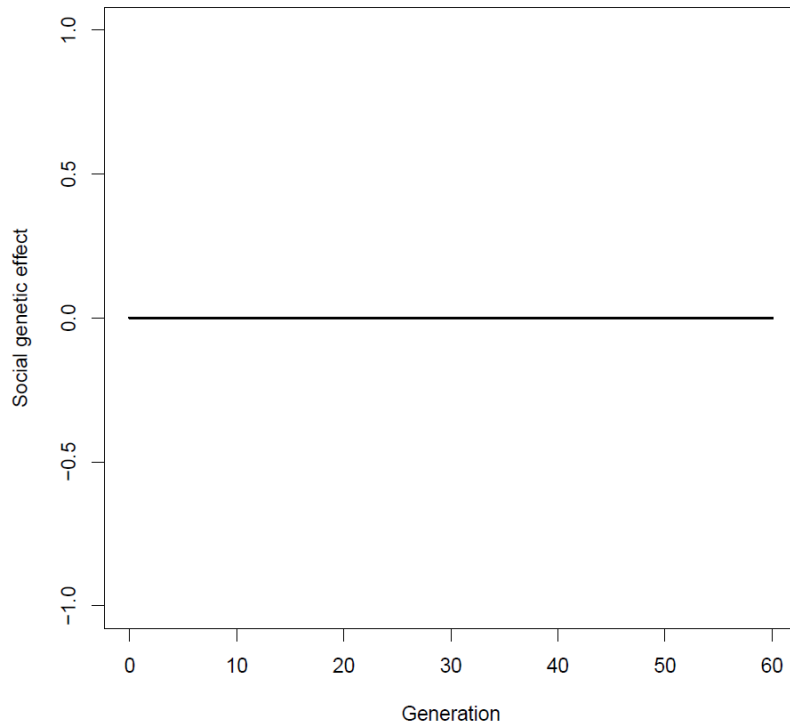
True classical model



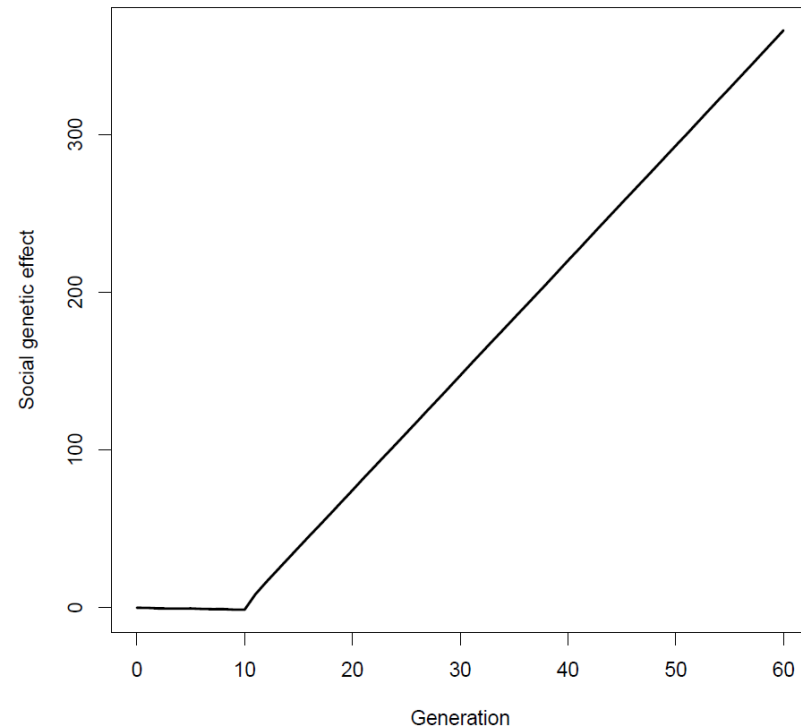
True social-genetic model

Simulations – Selection on true total genetic value – $dG(\text{social})$

Videncenter for
Svineproduktion



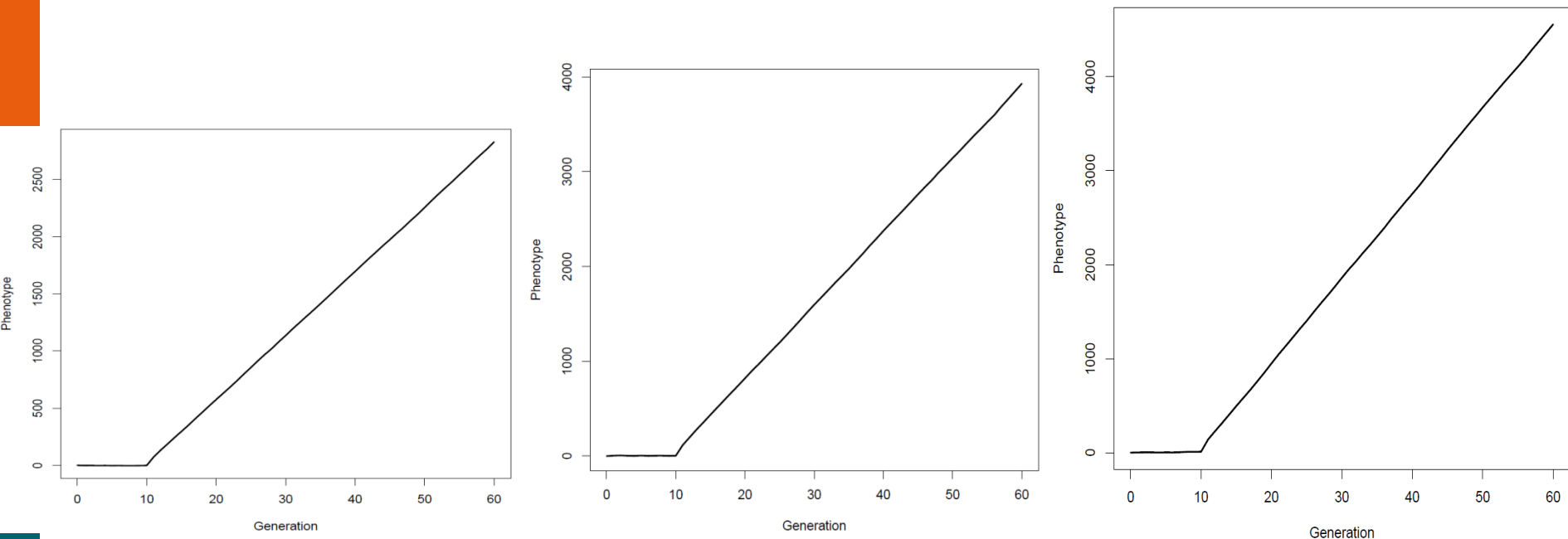
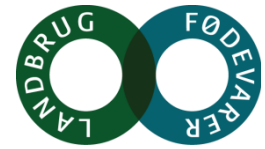
True classical model



True social-genetic model

Simulations – Selection on estimated TBV – dP (classical vs. social)

Videncenter for
Svineproduktion



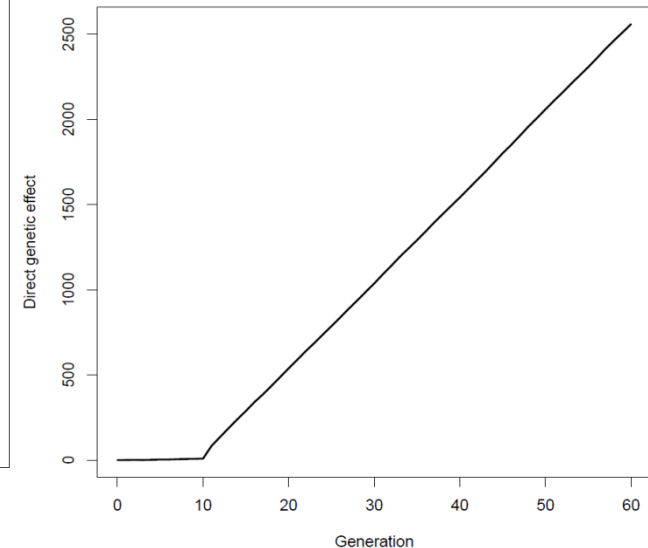
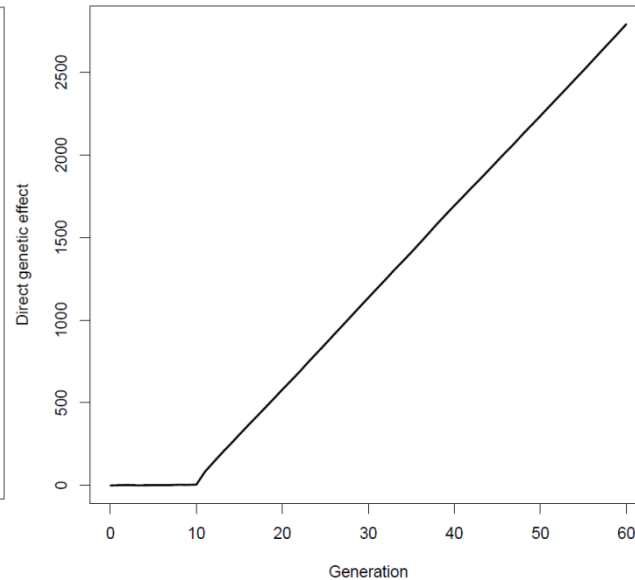
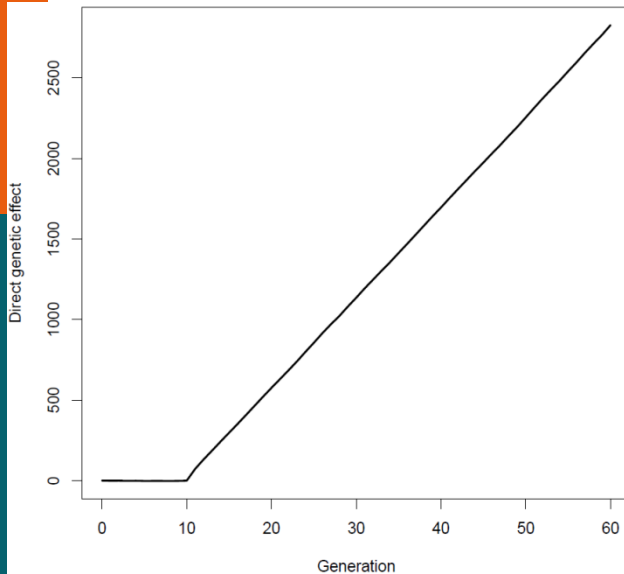
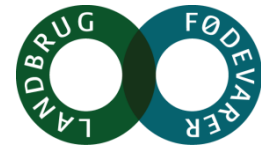
True classical model
Est classical model

True social-genetic model
Est classical model

True social-genetic model
Est social-genetic model

Simulations – Selection on estimated TBV – dG(direct)

Videncenter for
Svineproduktion



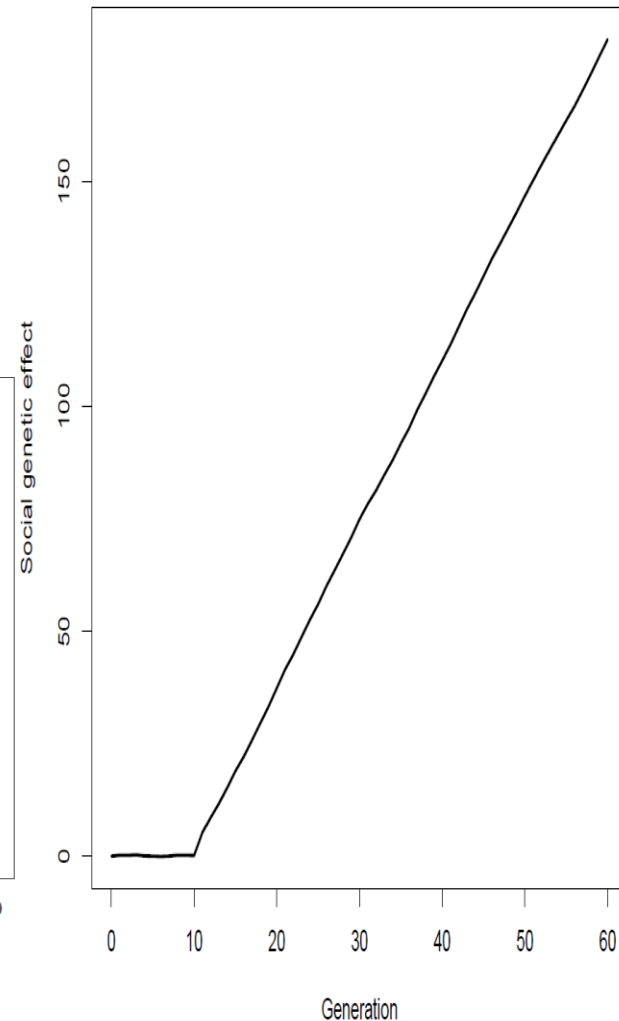
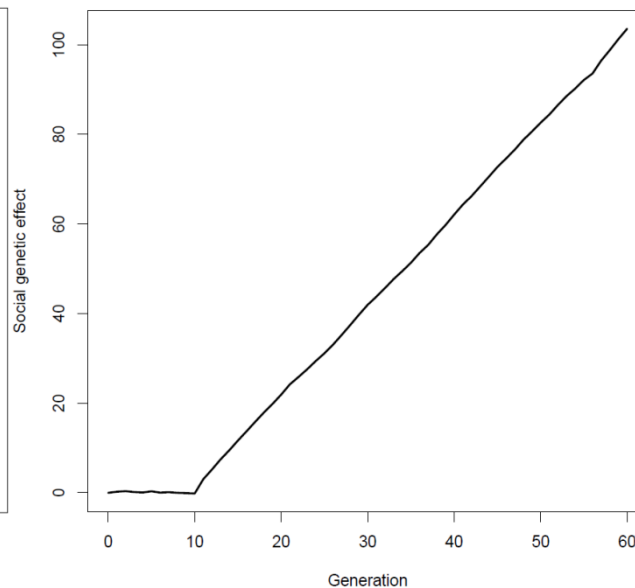
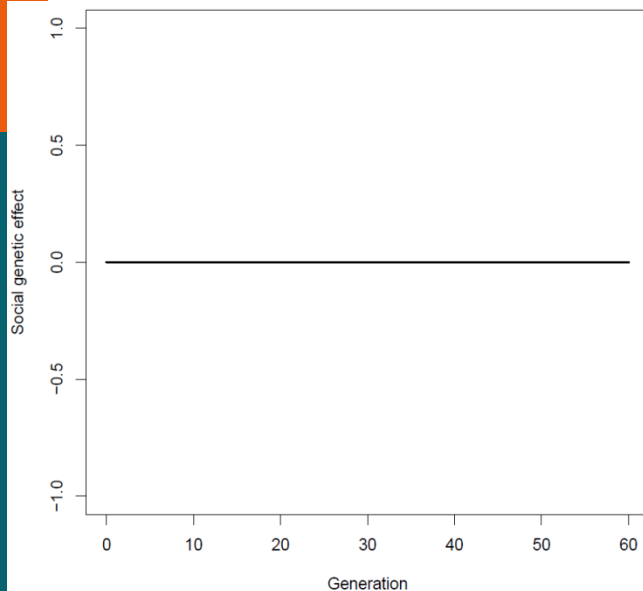
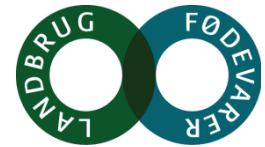
True classical model
Est classical model

True social-genetic model
Est classical model

True social-genetic model
Est social-genetic model

Simulations – Selection on estimated TBV – dG(social)

Videncenter for
Svineproduktion



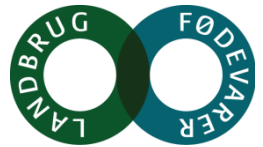
True classical model
Est classical model

True social-genetic model
Est classical model

True social-genetic model
Est social-genetic model

Take-home messages

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- **There may be social-genetic variation...**
- **Problems with data/model → simulations necessary!**
- **Prediction is difficult**
- **Gain lower than expected**