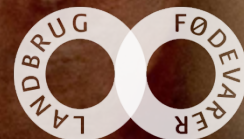# Genetic parameters of number of piglets nursed

B. Nielsen, T. Ostersen, I. Velander, S.B. Bendtsen, O. F. Christensen
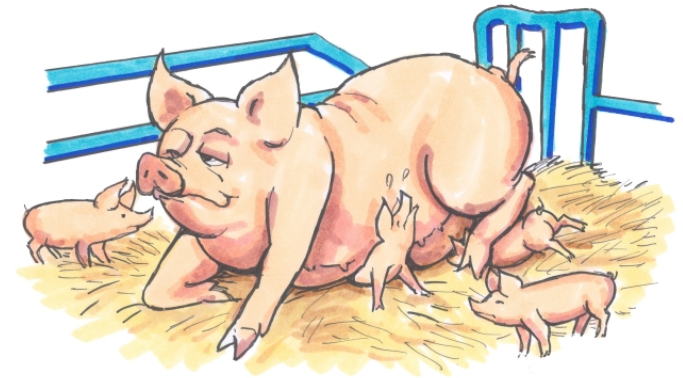
Pig Research Centre, Breeding & Genetics,
Axeltorv 3, 1609 Copenhagen V, Denmark;
Aarhus University, Denmark
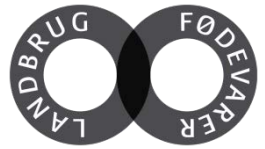
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Introduction

- Breeding for increased litter size has been very successful the last decades

- The increased litter size has required use of cross-fostering

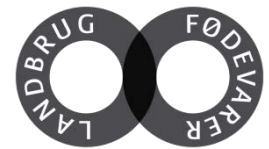- Farmers ask for sows with increased nurse capacity

Objective

The aim of this study was to develop a new trait, that describes the nurse capability (NC) of the sow
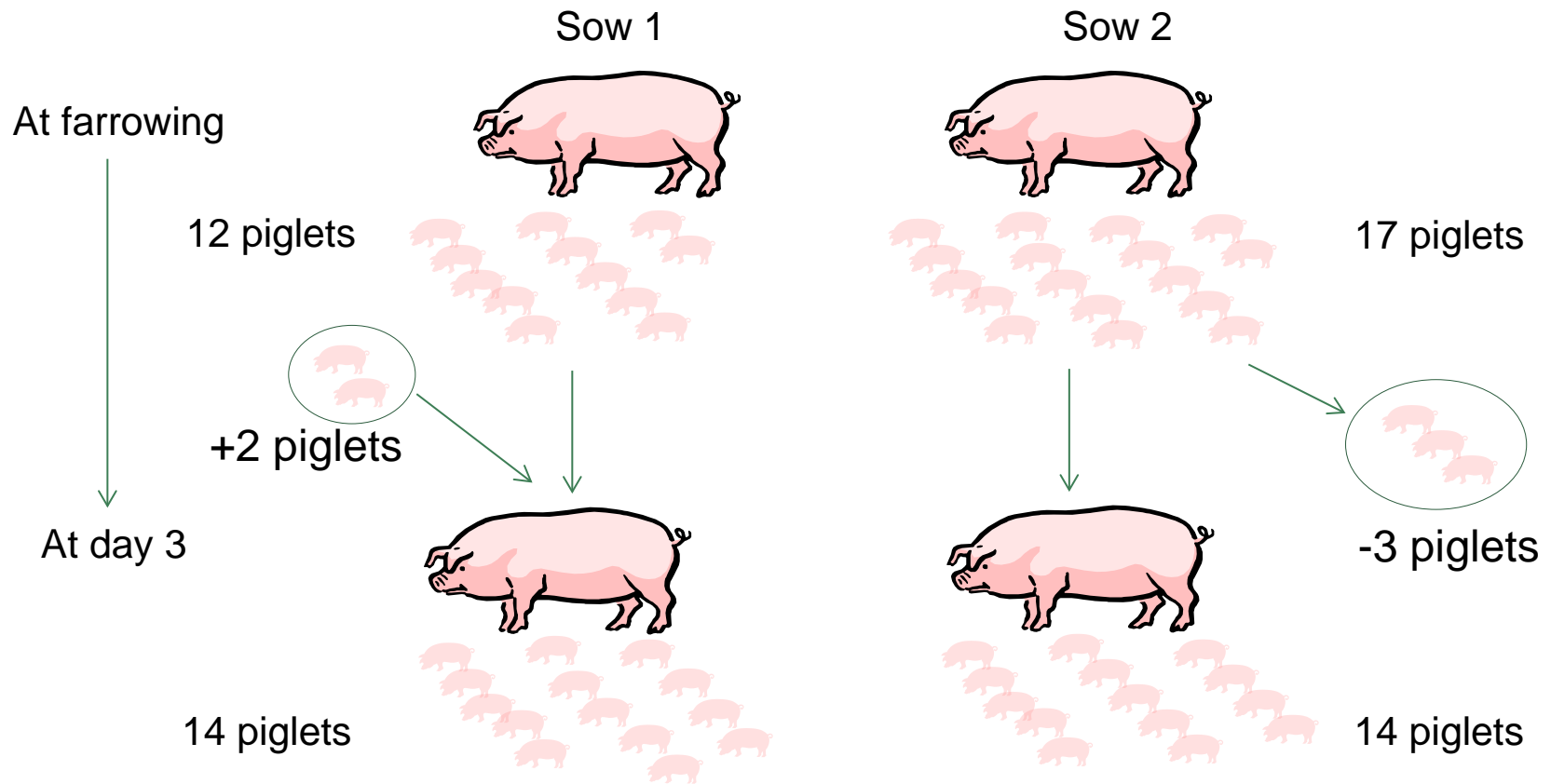
We need a trait that is heritable

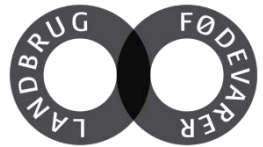# Definition of trait: NC Number of piglets nursed

- given 14 piglets per gilts
- at 3 days after farrowing

Sow 1

Sow 2

At farrowing

12 piglets

17 piglets

+2 piglets

At day 3
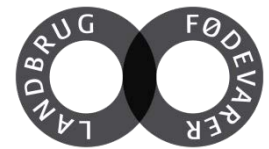
-3 piglets

14 piglets
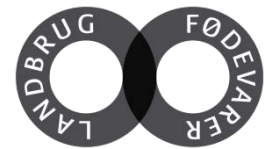
14 piglets

The experiment

- NC was measured in 3 large production herds from 2010 to 2013

- All sows were Landrace and Yorkshire crossbred gilts

- All terminal sires were Duroc AI boars

- At farrowing the total number of born (TNB) was recorded including the number of stillborn

- Litter size at day five (LS5) was recorded

Number of animals

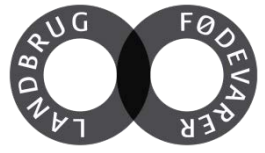| Type of animal	Number of gilts
Cross bred gilts TNB LS5 NC	11247 9647 9902
Pure bred gilts Landrace Yorkshire	59884 37495
Animals in pedigree	133205

Model(s)

Genetic related to parents:

$$y_{LY} = X\beta + Zu + a_L + a_Y + e$$

$$a_L \sim N\left(0, A\frac{\sigma_L^2}{4}\right) \qquad a_Y \sim N\left(0, A\frac{\sigma_Y^2}{4}\right)$$
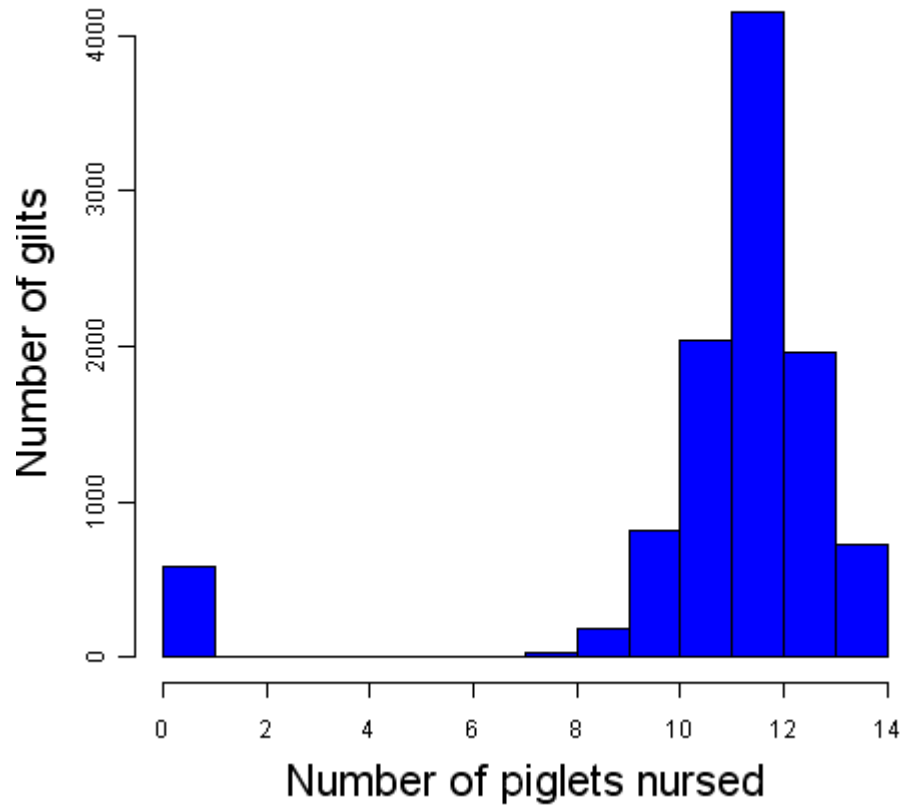
Fixed effects in X: Breed, herd-year, age at first parity

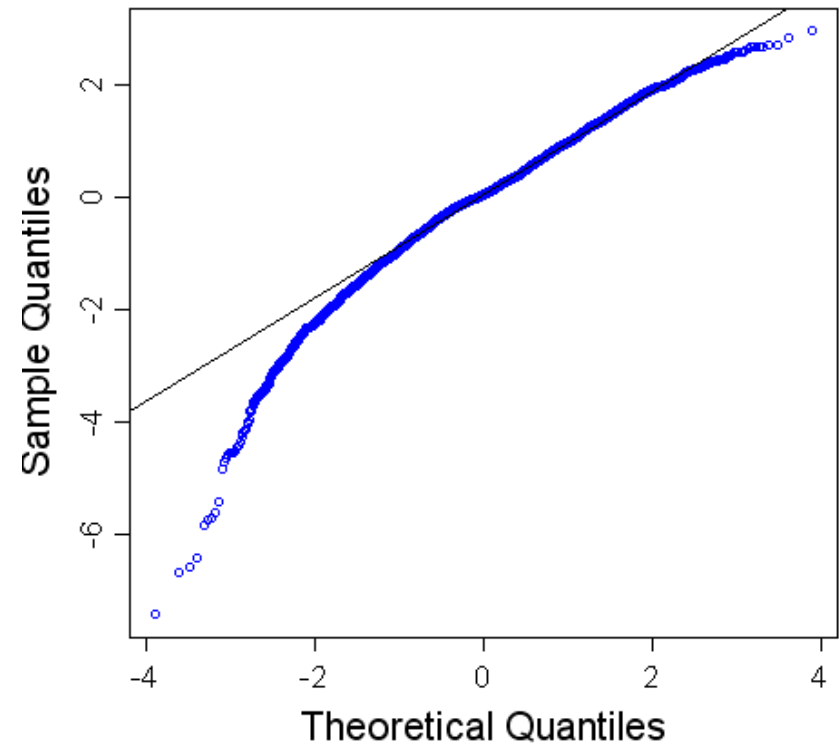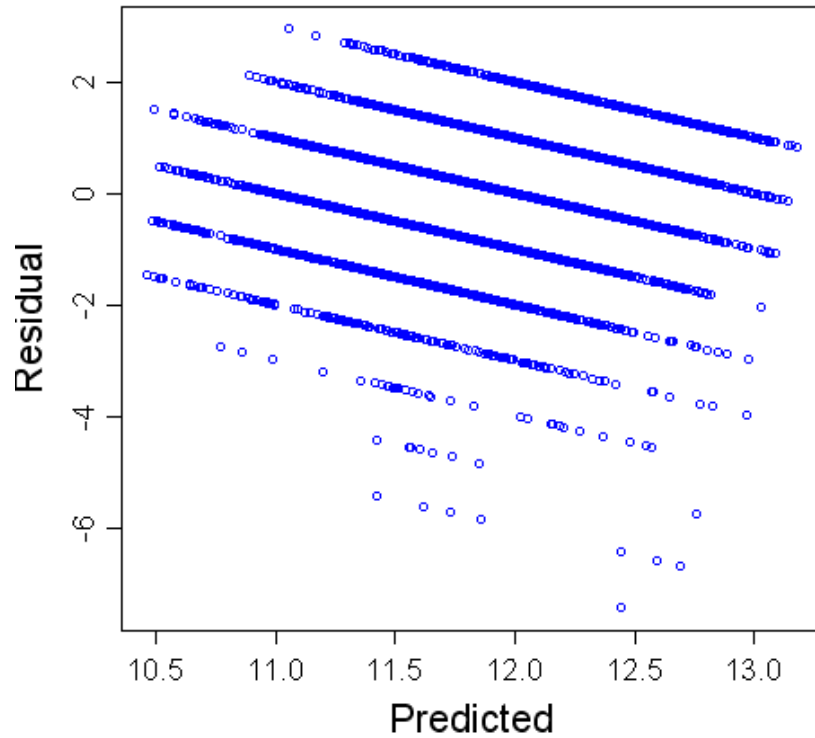Random effects in Z: herd-year-month

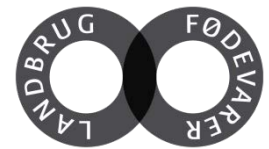(DMU, Jensen and Madsen, 200)

Results

Histogram of NC

Residuals

Problem: Thin tails in the distribution !

(Co)variances

Data obtained on F_1 gilts (LY/YL) in production

Phenotypic variances

	F_1: LY		
	TNB	LS5	NC
TNB	8.8 ±0.1	8.2 ±0.1	0.2 ±0.03
LS5		9.3 ±0.1	0.04 ±0.03
NC			1.2 ±0.03

Genetic variances

	F_0: Landrace			F_0: Yorkshire		
	TNB	LS5	NC	TNB	LS5	NC
TNB	0.40 ±0.15	0.45 ±0.16	0.02 ±0.04	0.88 ±0.22	0.84 ±0.22	-0.03 ±0.05
LS5		0.68 ±0.18	-0.03 ±0.05		0.95 ±0.24	-0.02 ±0.06
NC			0.06 ±0.02			0.07 ±0.03

Heritability and correlations

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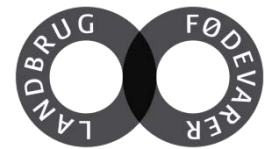
Data obtained on F_1 gilts (LY/YL) in production

	F_0: Landrace			F_0: Yorkshire		
	TNB	LS5	NC	TNB	LS5	NC
TNB	0.05 ±0.02	0.94 ±0.03	0.12 ±0.27	0.10 ±0.03	0.92 ±0.03	-0.11 ±0.23
LS5		0.06 ±0.02	-0.15 ±0.25		0.10 ±0.03	-0.06 ±0.22
NC			0.05 ±0.02			0.05 ±0.02

Heritability (on diagonal) and genetic correlation (above diagonal)

Heritability and correlations

Data obtained on F_0 (LL and YY) gilts + F_1 (LY/YL) gilts in production

Total Number of Born (TNB)

	TNB LL	TNB YY	TNB LY	NC
TNB (in nucleus LL)	0.09 ±0.008	-	0.69 ±0.12	-0.26 ±0.16
TNB (in nucleus YY)	-	0.07 ±0.008	0.53 ±0.03	-0.39 ±0.19
TNB (in production LY)	-	-	0.08 ±0.01	-0.11 ±0.16
NC (in production LY)	-	-	0.02 ±0.01	0.05 ±0.01

Heritability (on diagonal), residual correlation (below diagonal), genetic correlation (above diagonal)
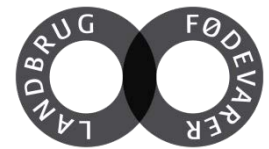
Wrong !!   animal model

Observed F_0 in 10 multiplier herds

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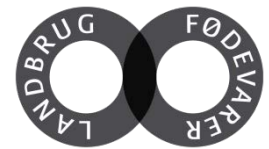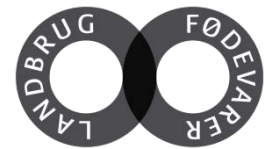
Trait: Number of nursed piglets until weaning

| Type of animal	Landrace	Yorkshire	Production
Number of animals	10666	11102	11247
Genetic variances in gilts	0.11	0.15	0.06; 0.07
Heritability in gilts	0.05	0.05	0.05; 0.05

Summery

➢ Nurse capacity was heritable and had heritability about 0.05

➢ Genetic correlation between NC and TNB was non-significant

➢ Problems with censoring and normality

➢ An additional study in multiplier herds with no limitations of litter equalization shows heritability of about 0.05, and the correlation to TNB was non-significant
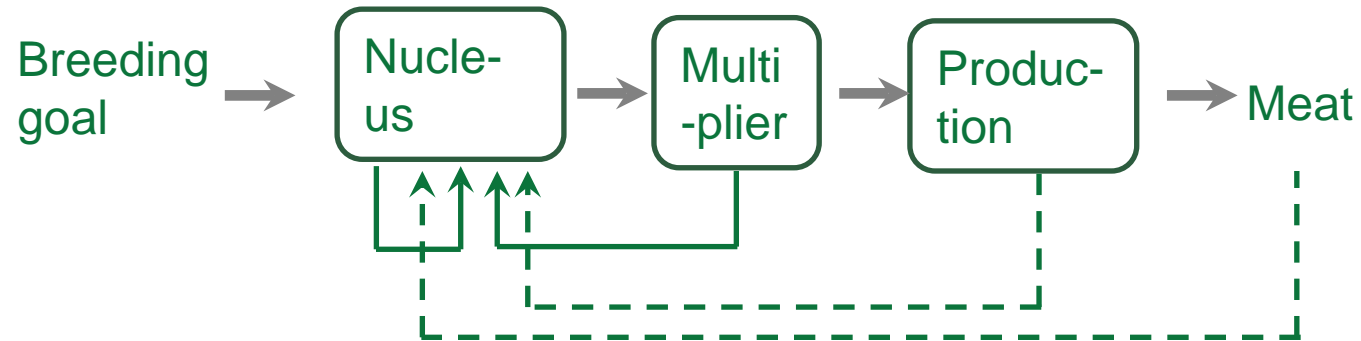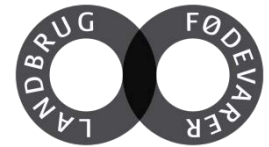
Genomic project

Three-way-cross production

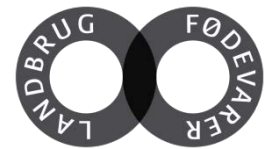Danish Yorkshire   X   Danish Landrace

LY/YL   X   Duroc
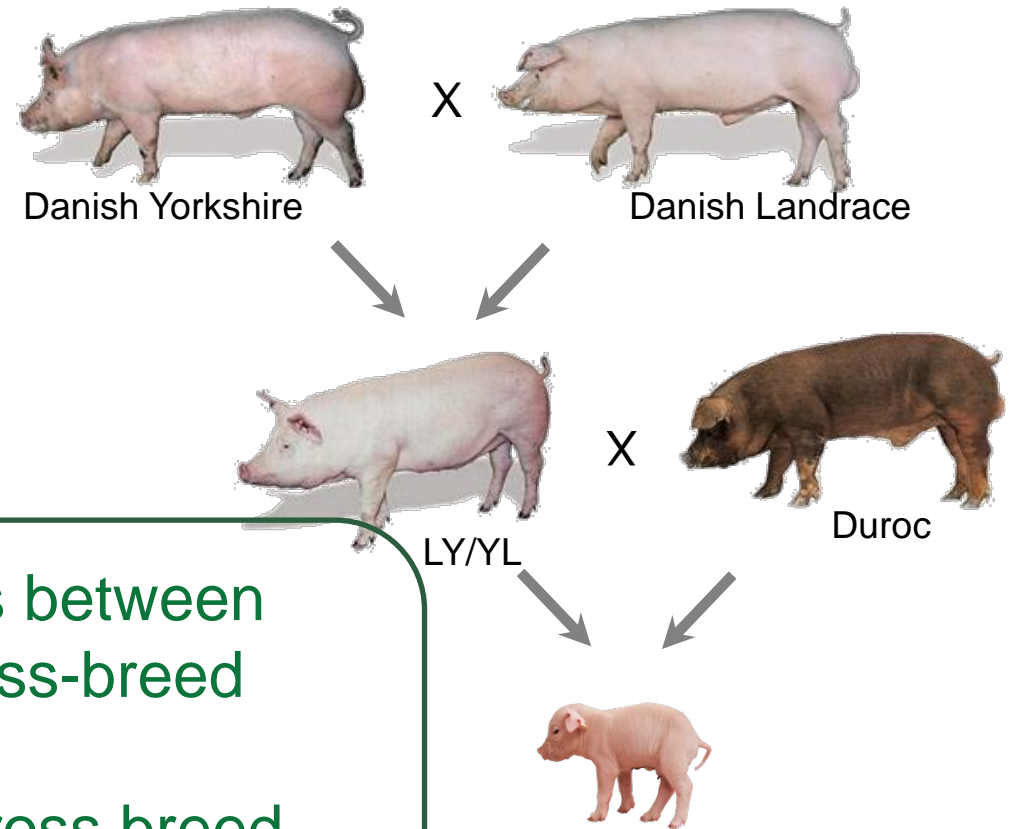
- Identifying relations between pure breed and cross-breed

- Can we combine cross breed and pure breed phenotypes by genomic information ?

Genetic evaluation

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No of obs. for each trait combination

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	TNB	LS5	TNB	LS5	NC
TNB (in nucleus)	97379				
LS5 (in nucleus)	97186	97186			
TNB (in production)	0	0	11247		
LS5 (in production)	0	0	9647	9647	
NC (in production)	0	0	9902	8302	9902