

# Genetic analysis of female fertility traits in beef cattle in the Czech Republic

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# Introduction

- Female fertility traits
  - Economically important traits
  - Directly related to profitability of beef production
  - Should be included as part of the breeding goal

# Objective

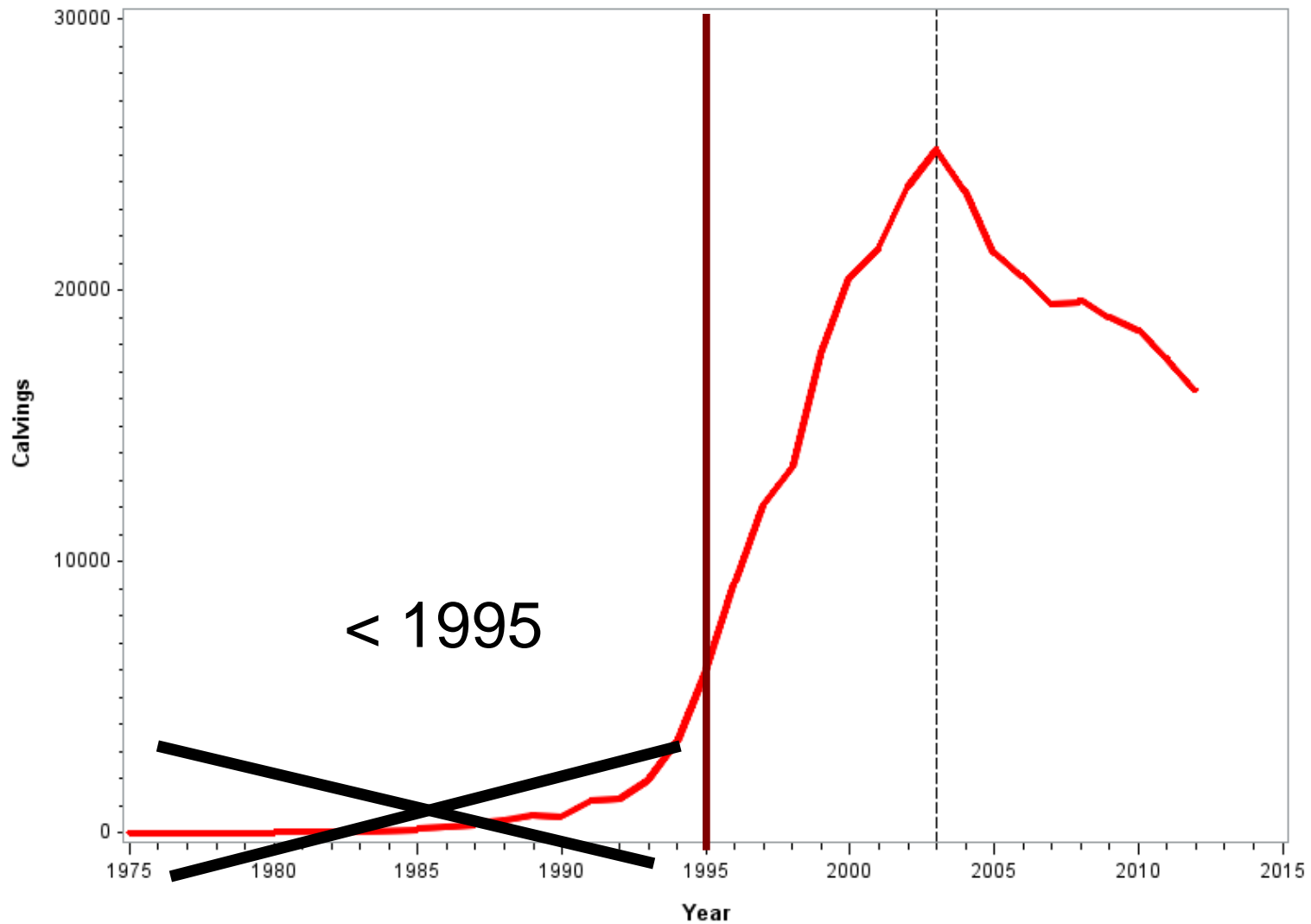
- Analyze female fertility traits
- Estimate genetic parameters
- Predict breeding values
- For routine genetic evaluation

# Material and methods

- Database of performance testing – „Field test“
  - From Czech Beef Breeders Association
- 333,000 calves
- 12 beef breeds and crosses

# Material and methods

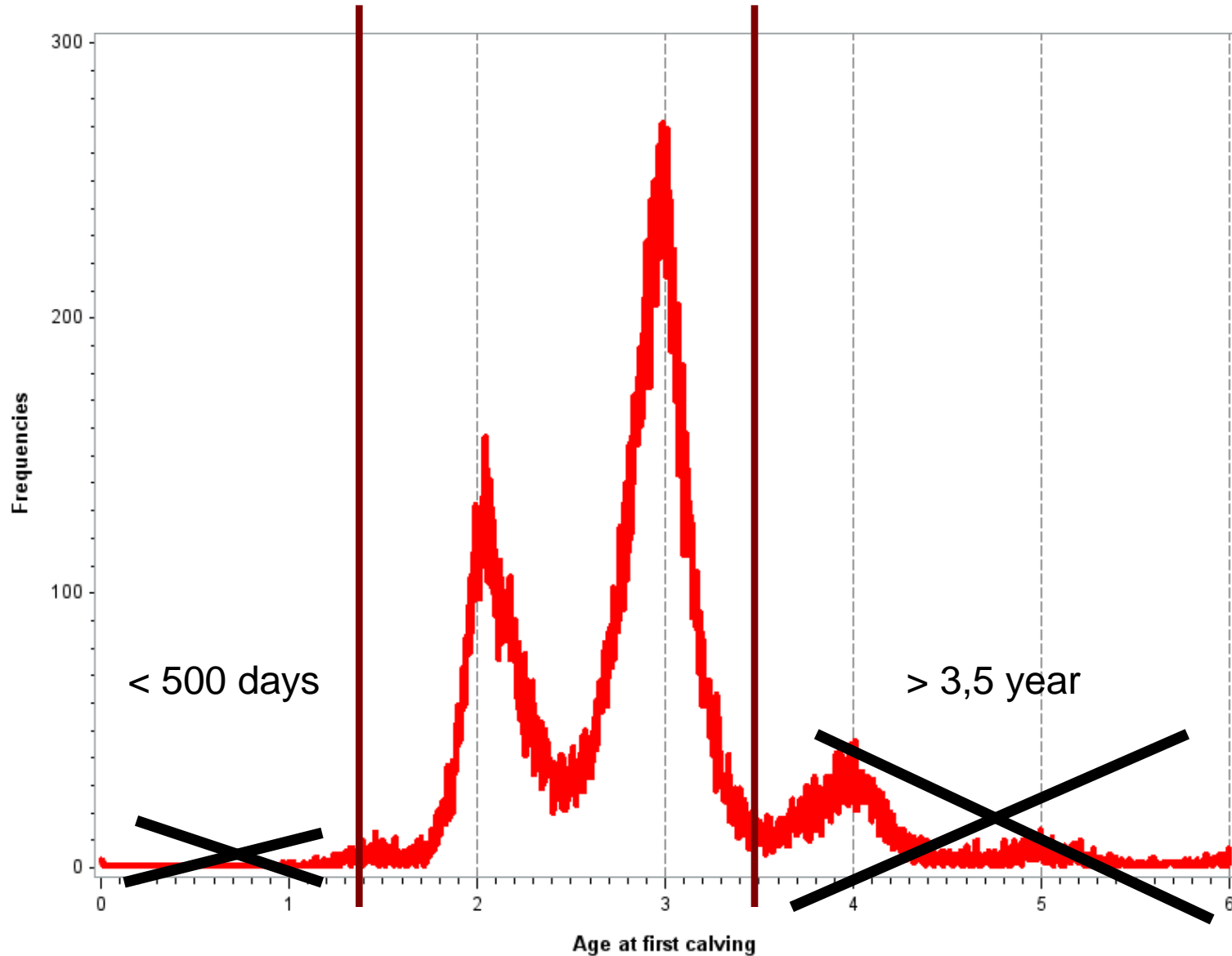
Frequencies of calvings by year



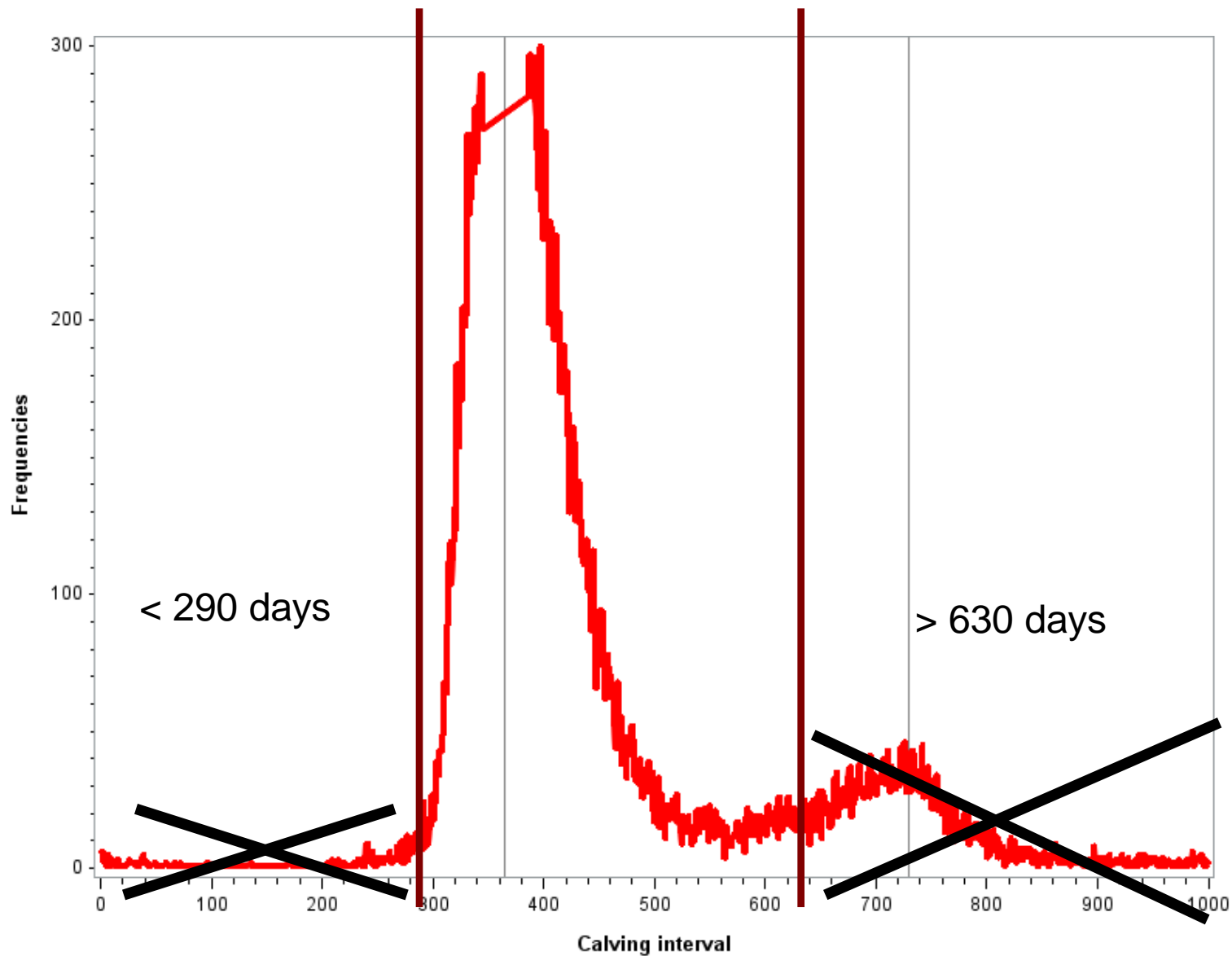
# Material and methods

- Chosen 3 female fertility traits
  1. Age at first calving (AF)
  2. Calving interval (CI)
    - The interval between first and second calving
  3. Lifespan (LS)

# Age at first calving



# Calving interval





# Lifespan

- Parity the cow attained or was predicted if data were censored
  - Censored data
    1. Cow survived beyond parity 5
    2. No sufficient time for the cow to have completed five parities

# Lifespan

- Censored data
  - Assigned LS following Brotherstone et al. (1975):

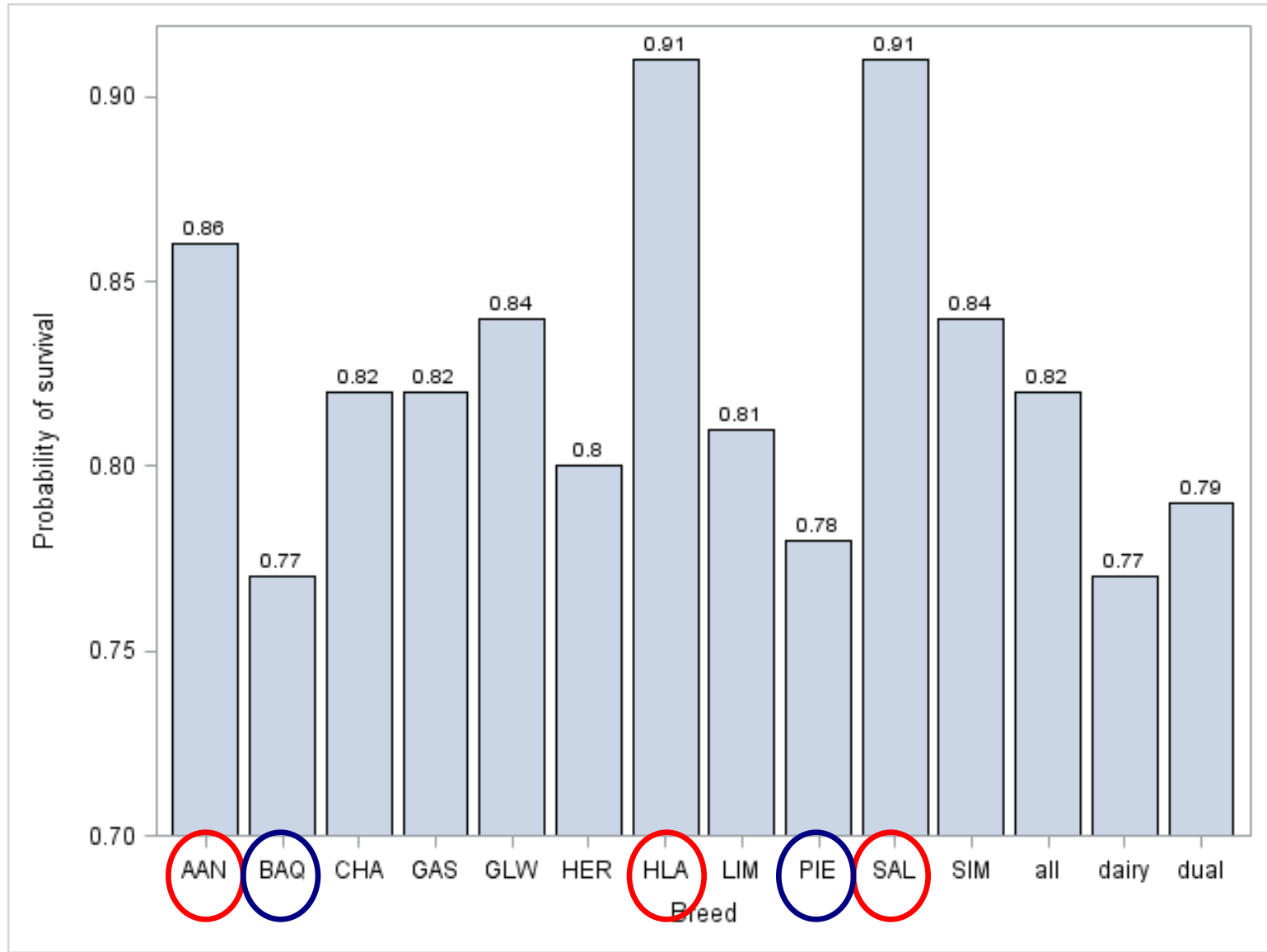
$$LS = n + p_n + p_n \cdot p_{n+1} + p_n \cdot p_{n+1} \cdot p_{n+2} + \dots$$

- $n$  – known number of parities completed
- $p_n$  – probability of survival from one parity to next

# Lifespan

- Probability of survival from one parity to next ( $p_n$ )
  - Dataset of cows born 1995 - 2001

# Probability of survival by breeds



# Material and methods

- Linear model approach
- Multi-trait animal model
- Relationship matrix with genetic groups based on the breed

# Basic statistics of data set

	N	Mean	SD	Min	Max
Age at first calving	51,954	973.55	167.1	500	1277
Calving interval	28,999	389.57	57.67	290	630
Lifespan	60,141	4.07	2.57	1	8.63

# Dataset for genetic parameters estimation

- After adjusting for connectedness
  - 35,220 cows with age at first calving
  - 19,833 cows with calving interval
  - 40,033 cows with lifespan

# Model equation

	AF	CI	LS
Heterosis	FR	FR	FR
Age of dam (classes)	F		
Calving ease of first calving		F	F
Age at first calving (linear and quadratic)		FR	FR
Month of first calving		F	
Herd birth		F	
HYS birth	F		
HYS first calving		F	F
Animal (cow)	N	N	N
Residual error	N	N	N



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# Genetic parameters

	AF	CI	LS
AF	0.23	-0.01	-0.01
CI		0.39	-0.09
LS			0.27

# Genetic parameters

## Heritabilities

	AF	CI	LS
AF	0.23	-0.01	-0.01
CI		0.39	-0.09
LS			0.27

# Genetic parameters

## Genetic correlations

	AF	CI	LS
AF	0.23	-0.01	-0.01
CI		0.39	-0.09
LS			0.27

# Environmental effects

	AF	CI	LS
Heterosis	FR	FR	FR
Age of dam (classes)	F		
Calving ease of first calving		F	F
Age at first calving (linear and quadratic)		FR	FR
Month of first calving		F	
Herd birth		F	
HYS birth	F		
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Animal (cow)	N	N	N
Residual error	N	N	N

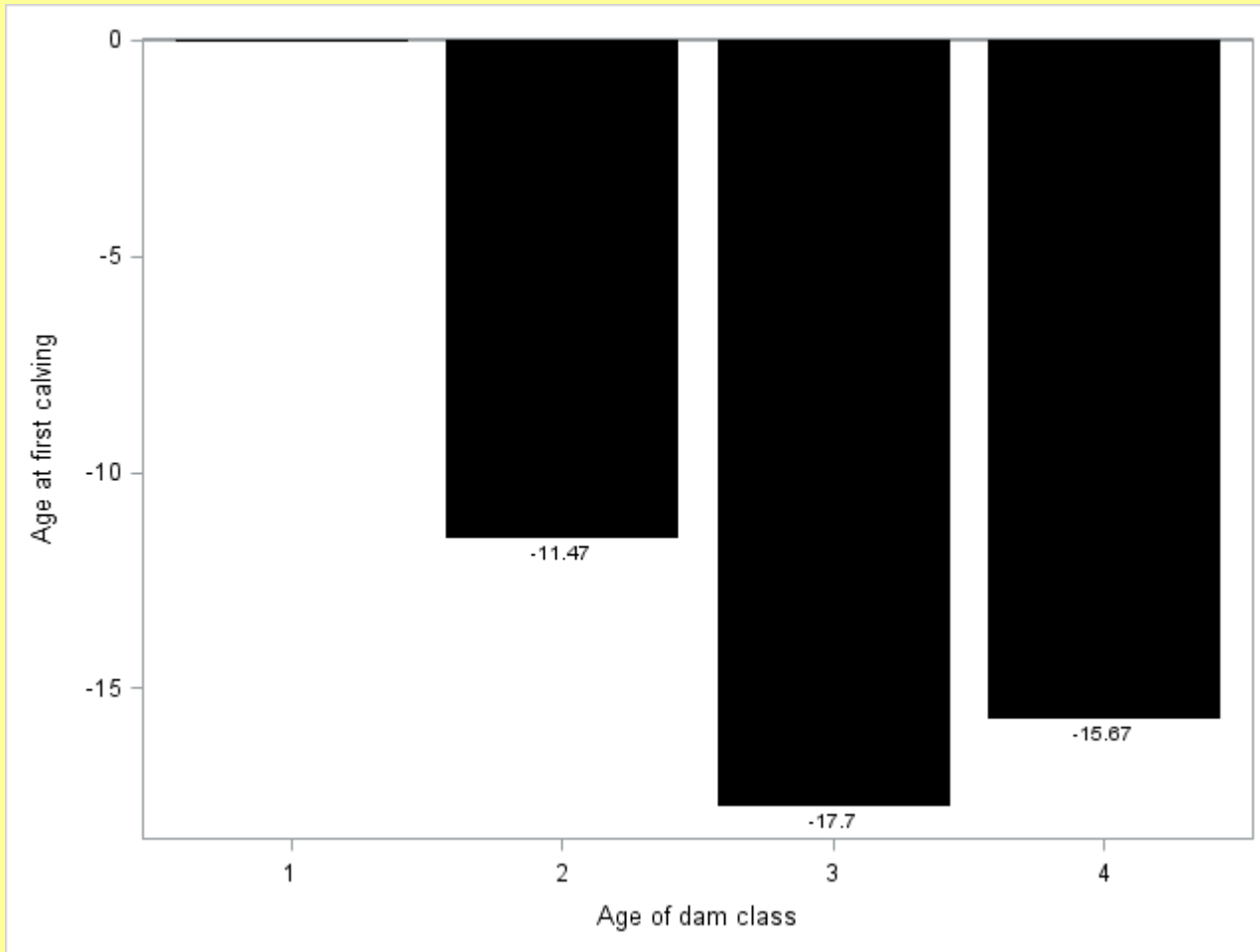
# Environmental effects

AF	CI	LS
- 13,28	- 5,57	- 0,10

AF	CI	LS
FR	FR	FR
F		
	F	F
	FR	FR
	F	
	F	
F		
	F	F
N	N	N
N	N	N



# Environmental effects



< 2 year

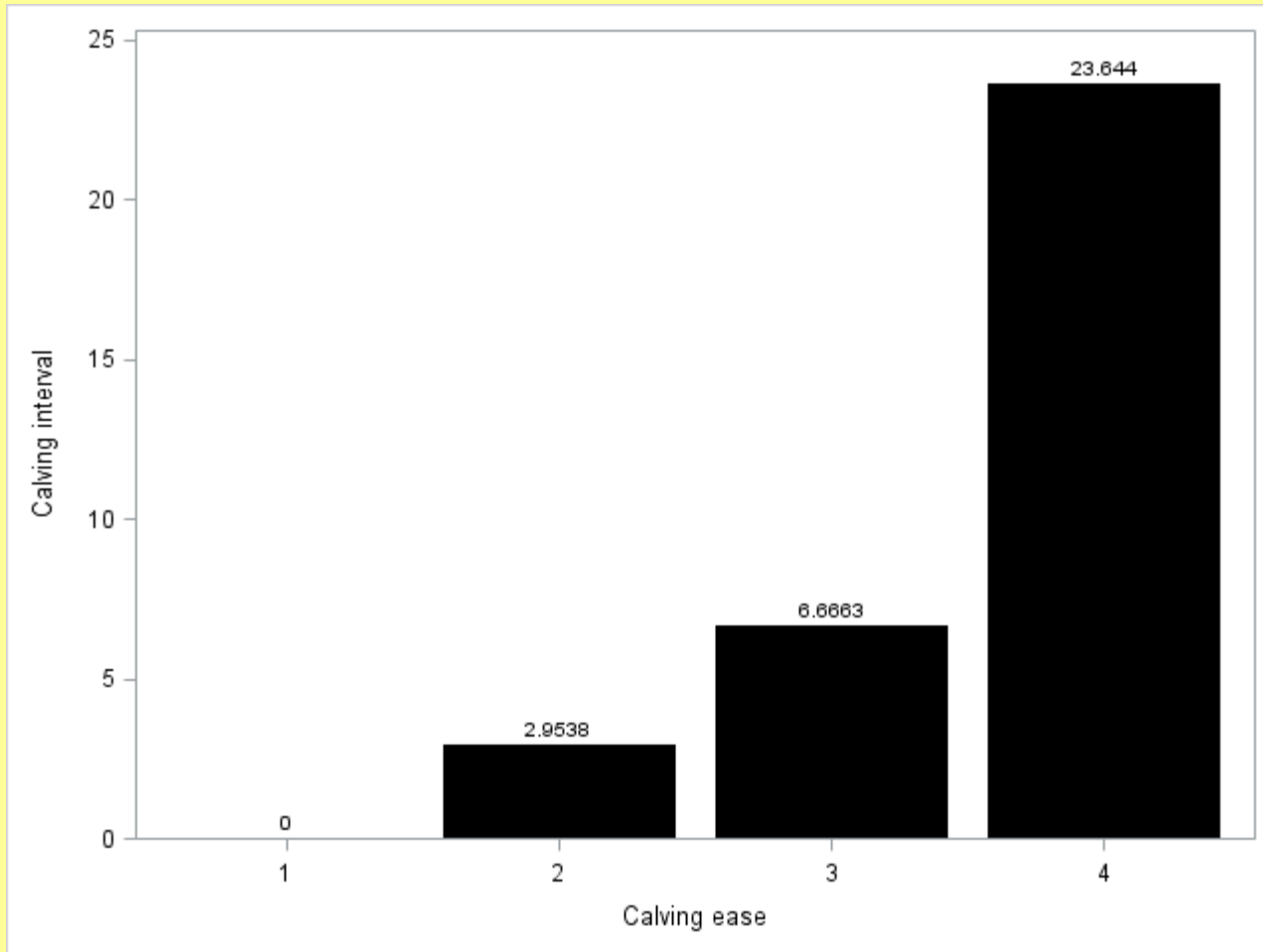
2 year

3 – 6 year

7 and older

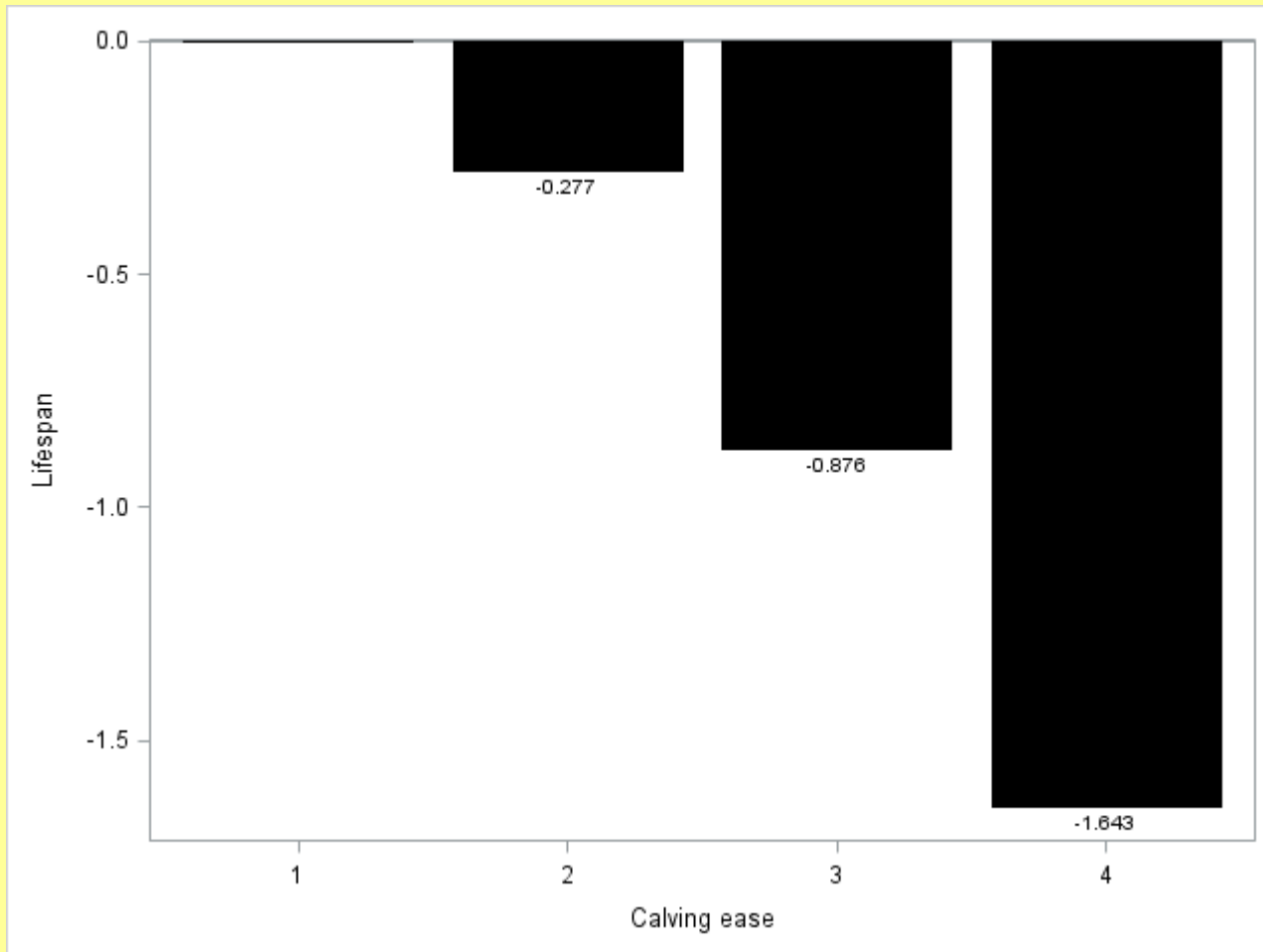
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FR	FR	FR
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	F	F
	FR	FR
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	F	
F		
	F	F
N	N	N
N	N	N

# Environmental effects



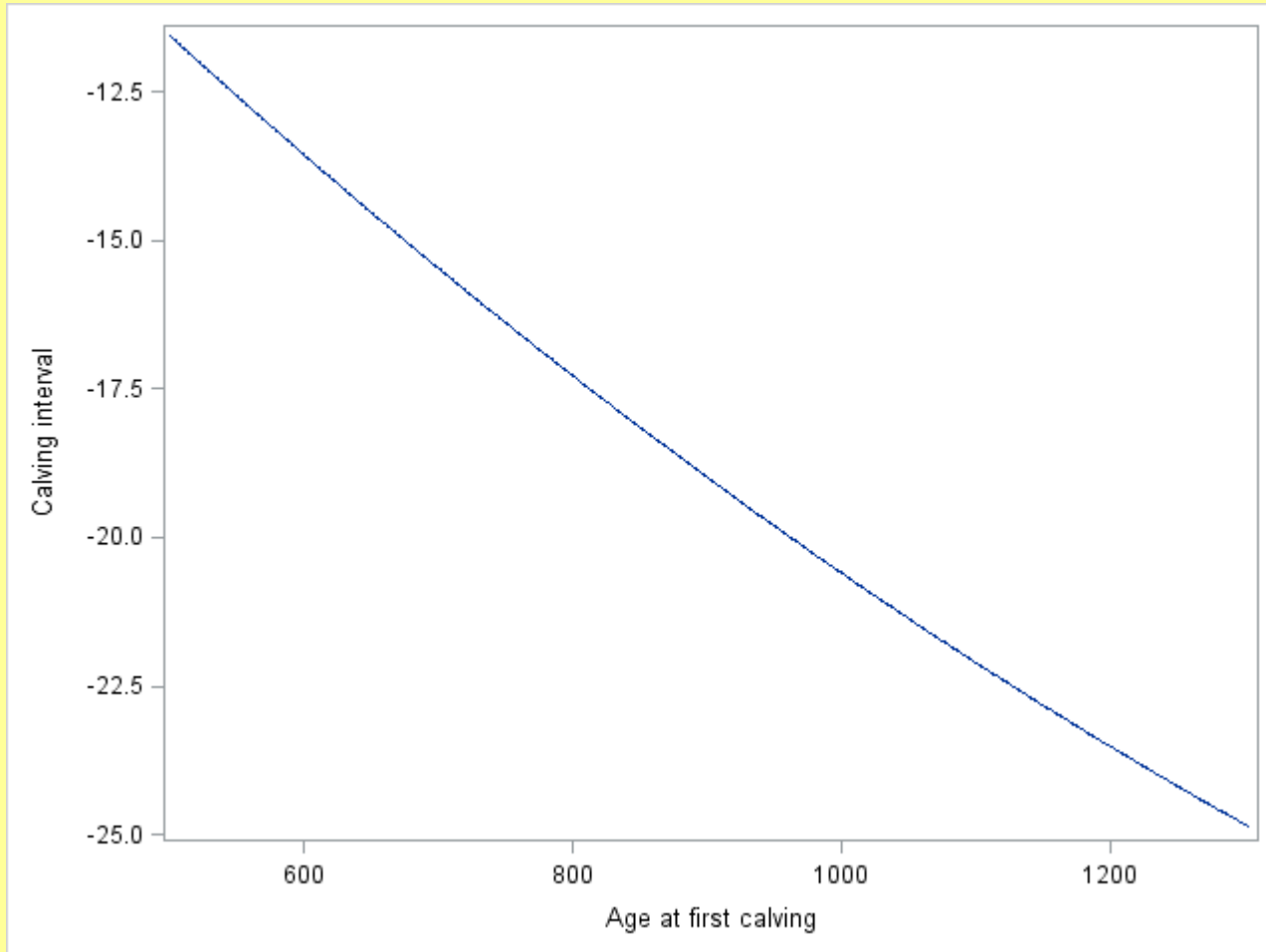
AF	CI	LS
FR	FR	FR
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N	N	N
N	N	N

# Environmental effects



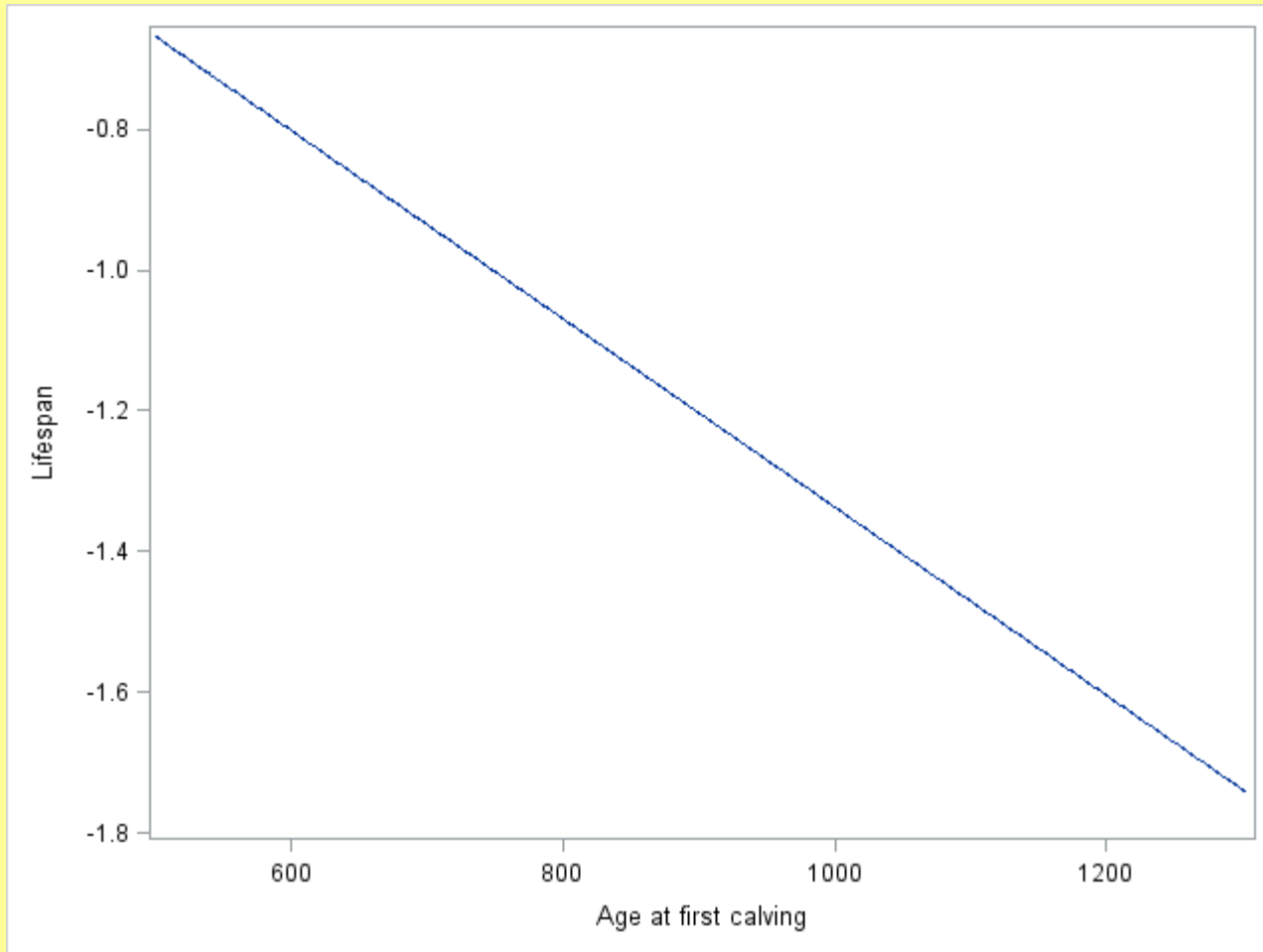
AF	CI	LS
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	F	F
N	N	N
N	N	N

# Environmental effects



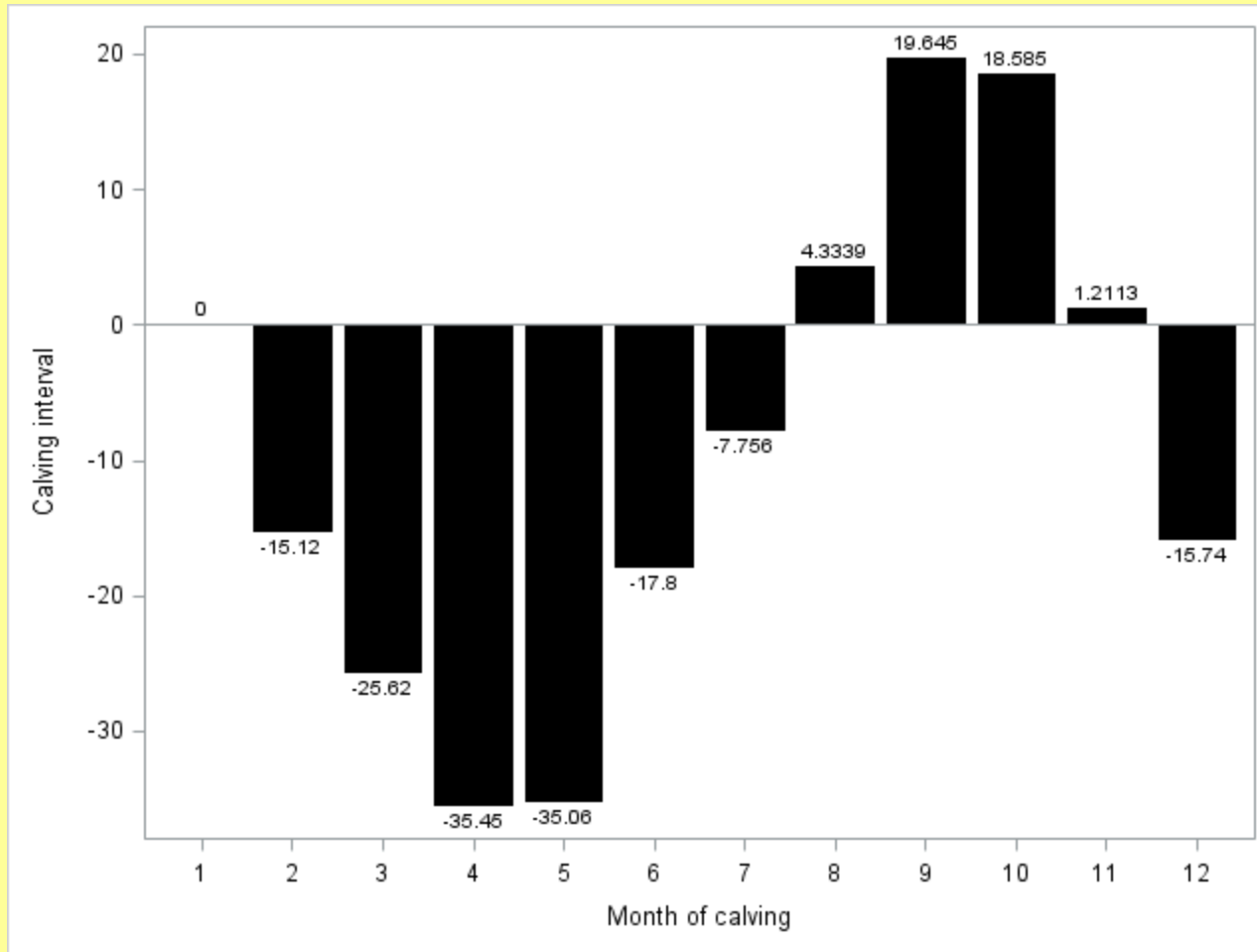
AF	CI	LS
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	F	F
N	N	N
N	N	N

# Environmental effects



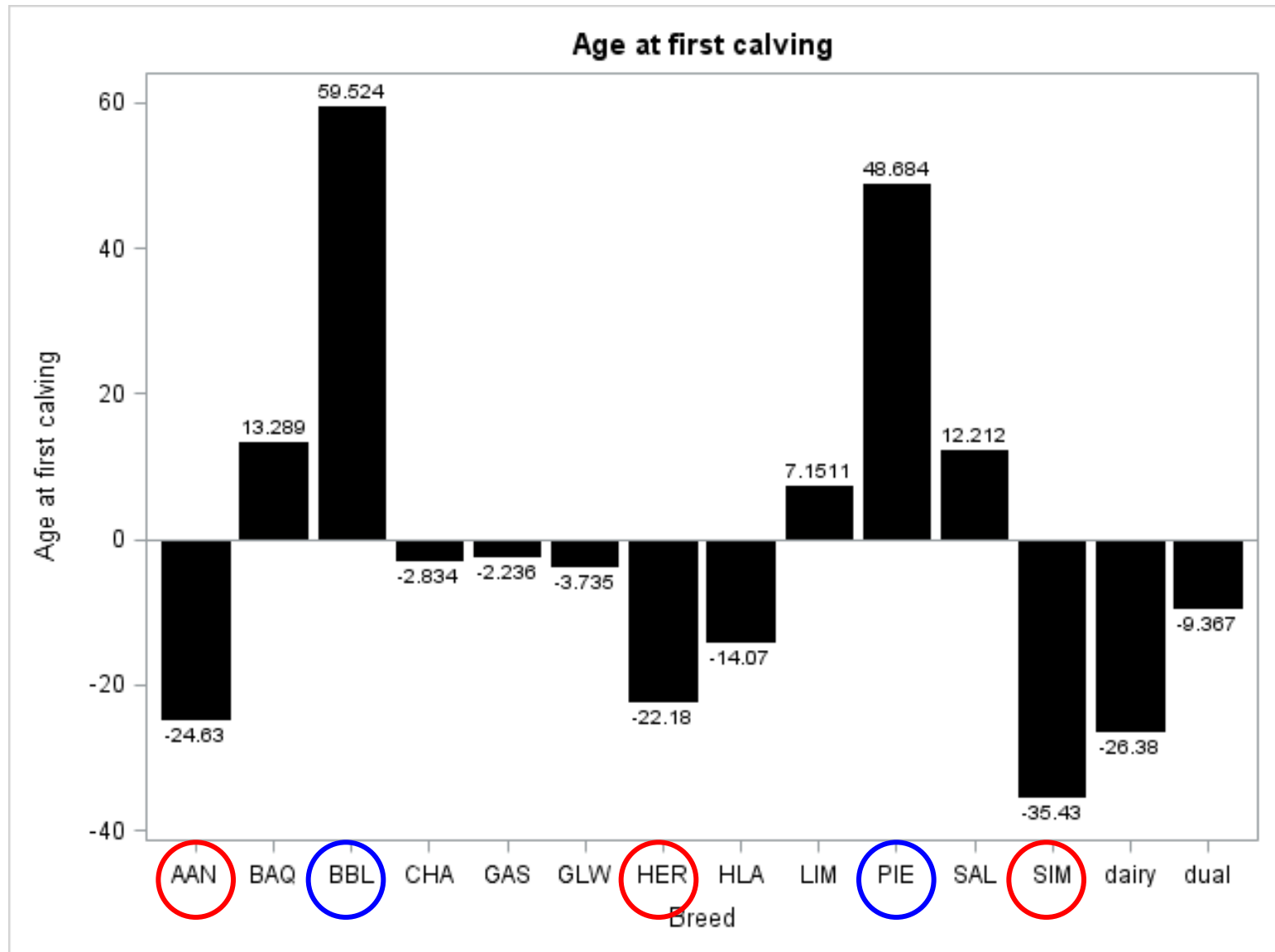
AF	CI	LS
FR	FR	FR
F		
	F	F
	FR	FR
	F	
	F	
F		
	F	F
N	N	N
N	N	N

# Environmental effects

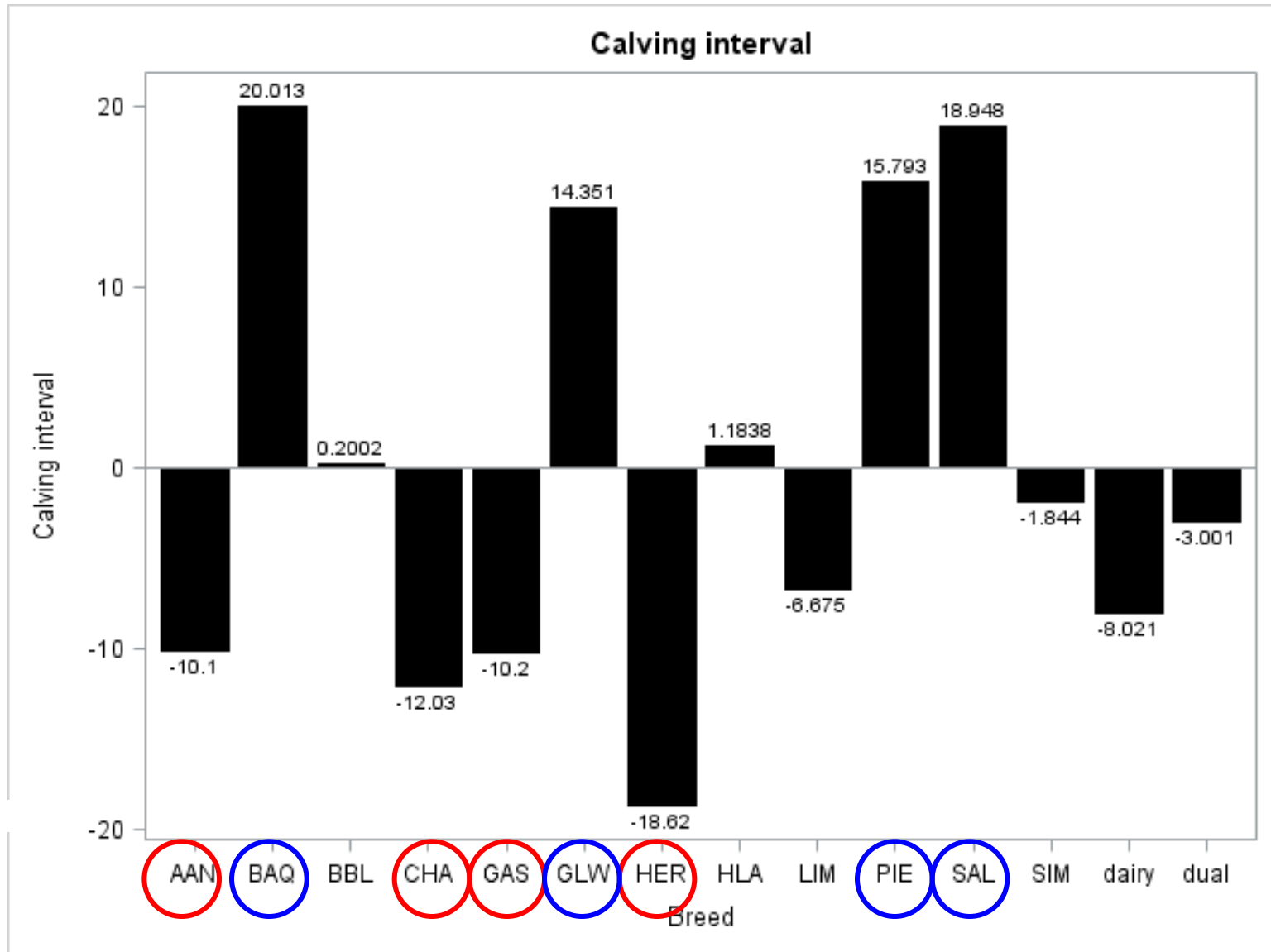


AF	CI	LS
FR	FR	FR
F		
	F	F
	FR	FR
	F	
	F	
F		
	F	F
N	N	N
N	N	N

# Breeding values in genetic groups based on breed

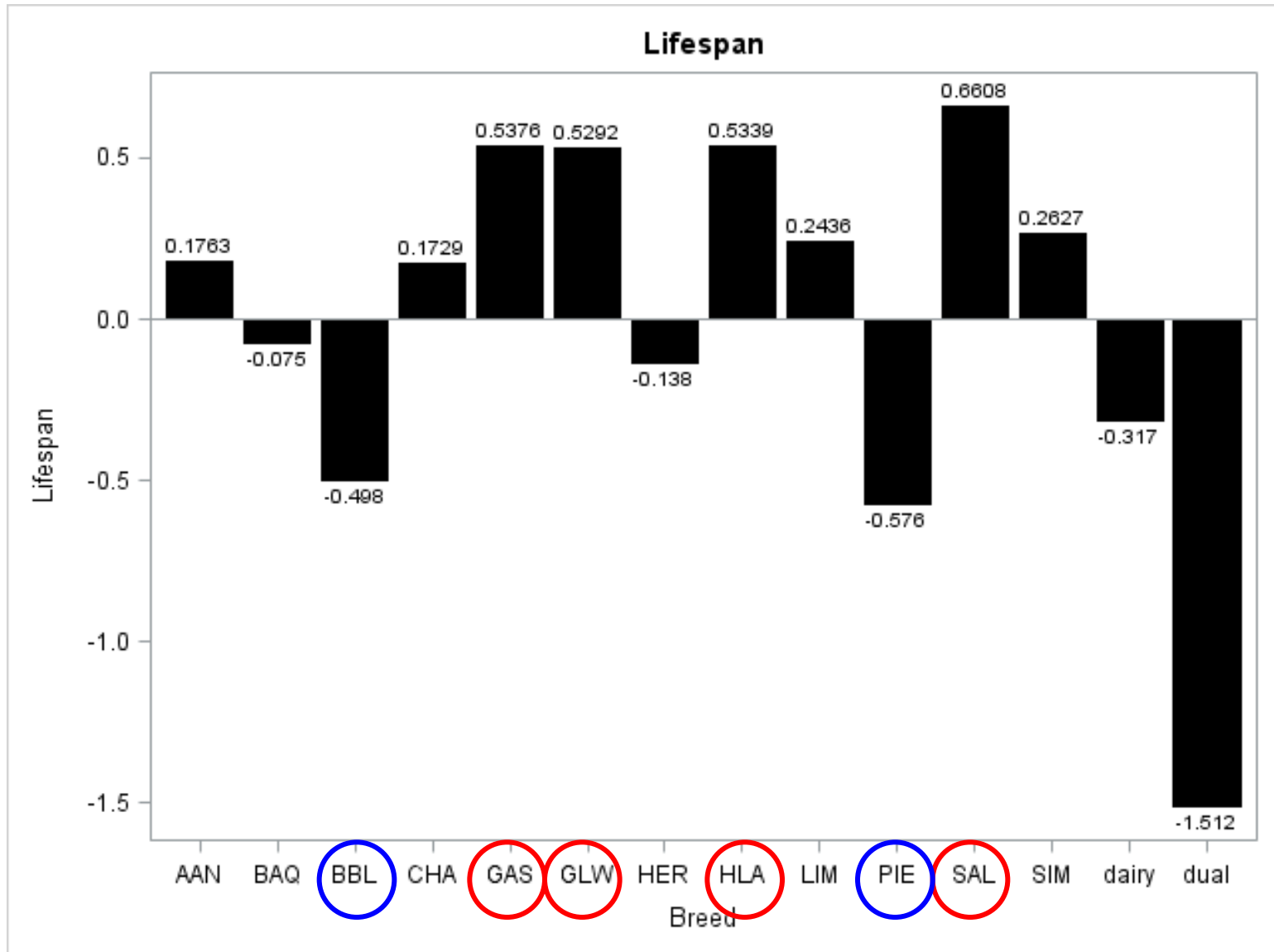


# Breeding values in genetic groups based on breed





# Breeding values in genetic groups based on breed



# Conclusions

- Chosen 3 fertility traits suitable for genetic evaluation
  - Age at first calving
  - Calving interval
  - Lifespan
- Linear animal model
- Still lots of work to do
  - Second, third, ... calving interval
  - Threshold model ?
  - Survival Kit ?

# Thank you for your attention



## Acknowledgements

The research was supported by the projects MZE 0002701404 and NAZV QJ1310184 of the Ministry for Agriculture of the Czech Republic.

Data of performance testing was provided by Czech Beef Breeders Association.