



# Improving the genetic evaluation for longevity in the Netherlands

**Mathijs van Pelt**  
Gerben de Jong  
Roel Veerkamp

August 27, 2017

# Aim

- Set up new genetic evaluation for longevity
- Compare with current genetic evaluation

# Genetic parameters

## New

- Linear random regression model
- Animal model
- Different trait across cow's life

MND	6	12	18	24	30	36	42	48	54	60	66	72
6	1.0	1.0	0.9	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.1	0.1
12	1.0	1.0	0.9	0.7	0.6	0.6	0.5	0.4	0.3	0.2	0.1	0.1
18	0.9	0.9	1.0	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5
24	0.7	0.7	1.0	1.0	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7
30	0.6	0.6	0.9	1.0	1.0	1.0	1.0	0.9	0.9	0.8	0.8	0.8
36	0.5	0.6	0.8	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9
42	0.4	0.5	0.8	0.9	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9
48	0.3	0.4	0.7	0.9	0.9	1.0	1.0	1.0	1.0	1.0	0.9	1.0
54	0.2	0.3	0.6	0.8	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0
60	0.1	0.2	0.6	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.0	1.0
66	0.1	0.1	0.5	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0
72	0.1	0.1	0.5	0.7	0.8	0.9	0.9	1.0	1.0	1.0	1.0	1.0

- $h^2 = 0.12$
- Gen.SD = 7.1 mo



## Current

- Proportional hazards model
- Sire-mgs model
- Same trait across cow's life

MND	6	12	18	24	30	36	42	48	54	60	66	72
6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
12	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
18	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
24	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
30	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
36	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
42	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
48	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
54	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
60	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
66	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
72	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

- $h^2 = 0.12$
- Gen.SD = 9.0 mo

# Statistical model

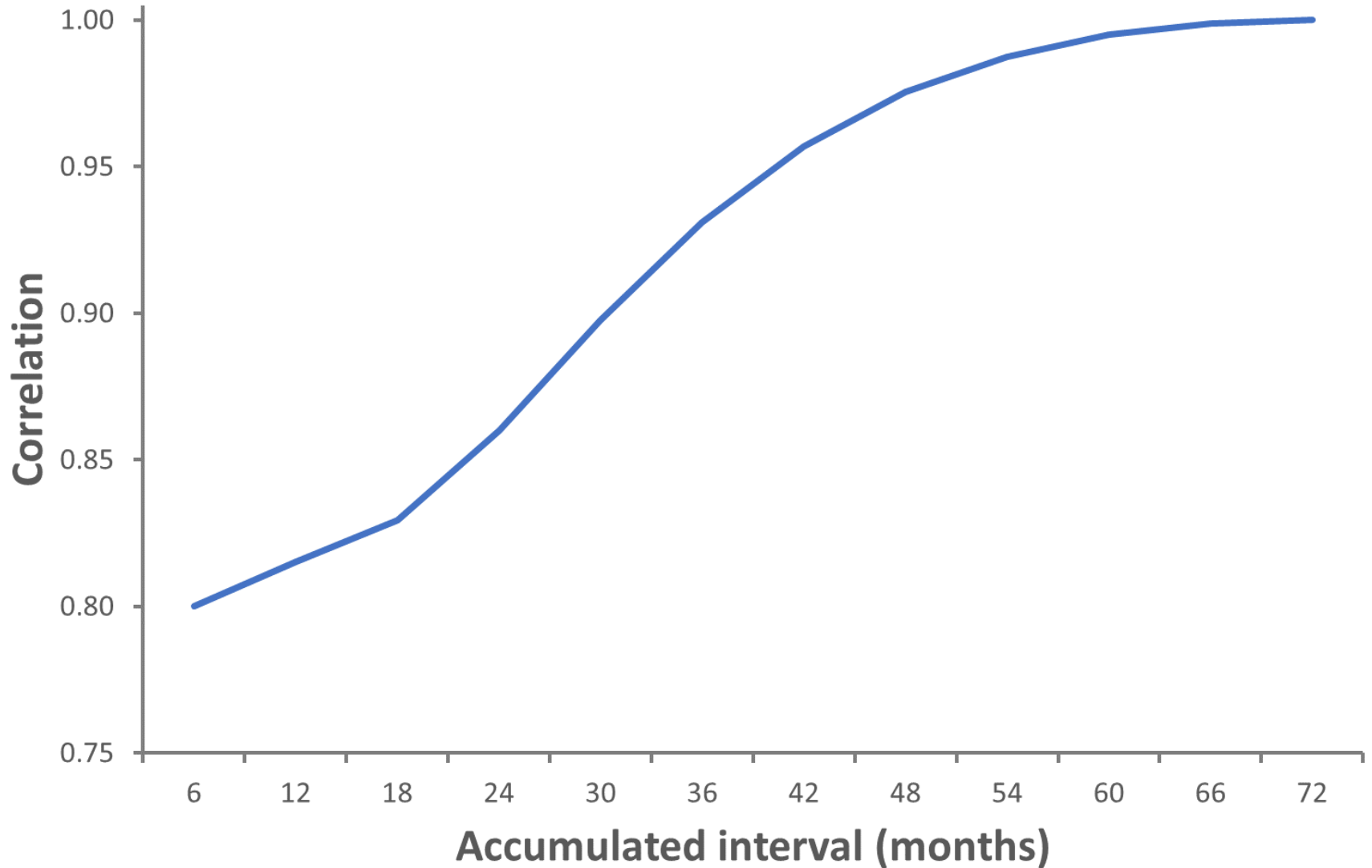
- Random regression animal model

$$Y = X\beta + Za + e$$

- $Y$  = Survival per month after first calving (month 1 – 72)
- $\beta$  = Fixed effects
  1. Herd-year-season x lactation-stage
  2. Year-season x AFC x prod x lactation-stage
  3. Herdsize change
  4. Heterosis
  5. Recombination
- $a$  = Additive genetic effect, 5<sup>th</sup> order Legendre polynomial
- $e$  = Residual

- Year-season of calving
- Lactation: 1, 2, 3+ for 1. and 1, 2, 3, 4, 5+ for 2.
- Stage: month 1-2, 3-9, 10+ and dry period
- AFC: age at first calving in months: 21, 22,...,34, 35+
- Prod: within-herd production level, 5 classes of 20%

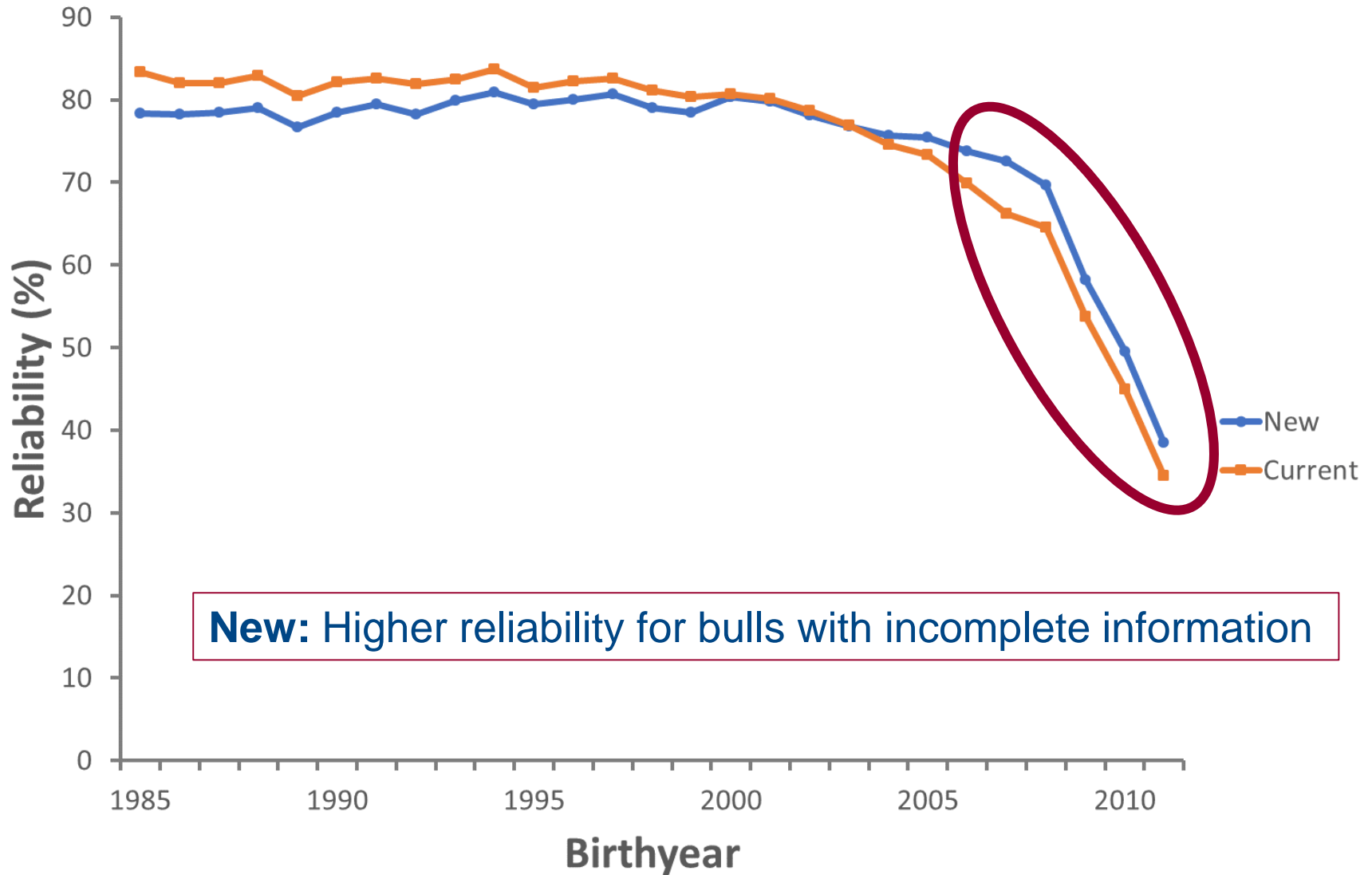
# Correlation between total life (1-72 mo) and accumulated intervals



# Comparison of new with current genetic evaluation

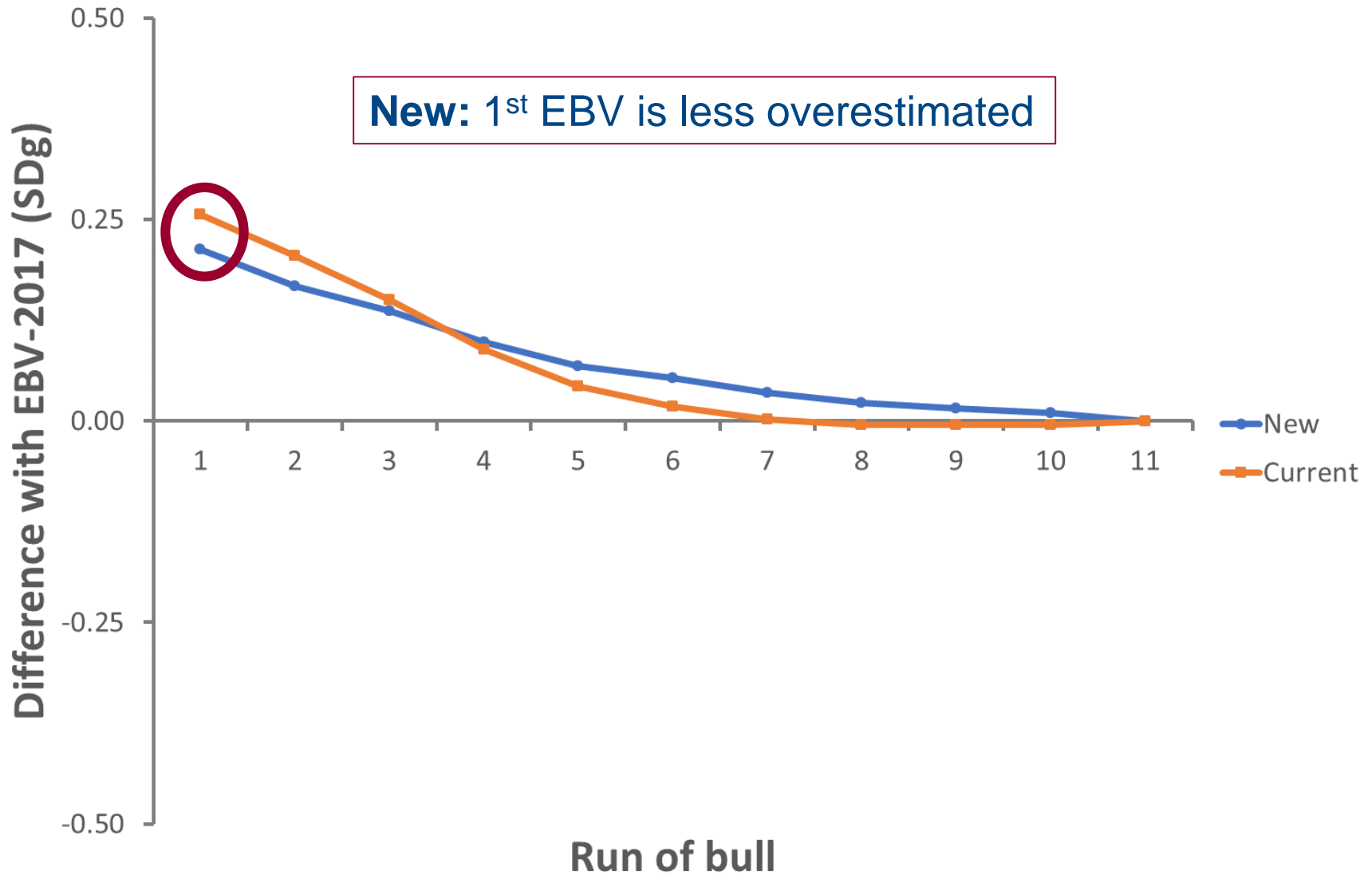
- One run per year from 2007 to 2017
- Compared on:
  - Reliability
  - Mean difference with latest EBV (2017)
  - Genetic correlations between EBV (2007 to 2017)
  - Genetic trends (2008, 2012, 2016)
- For first crop and second crop bulls
  - With first EBV in 2007 or later

# Reliability per birthyear



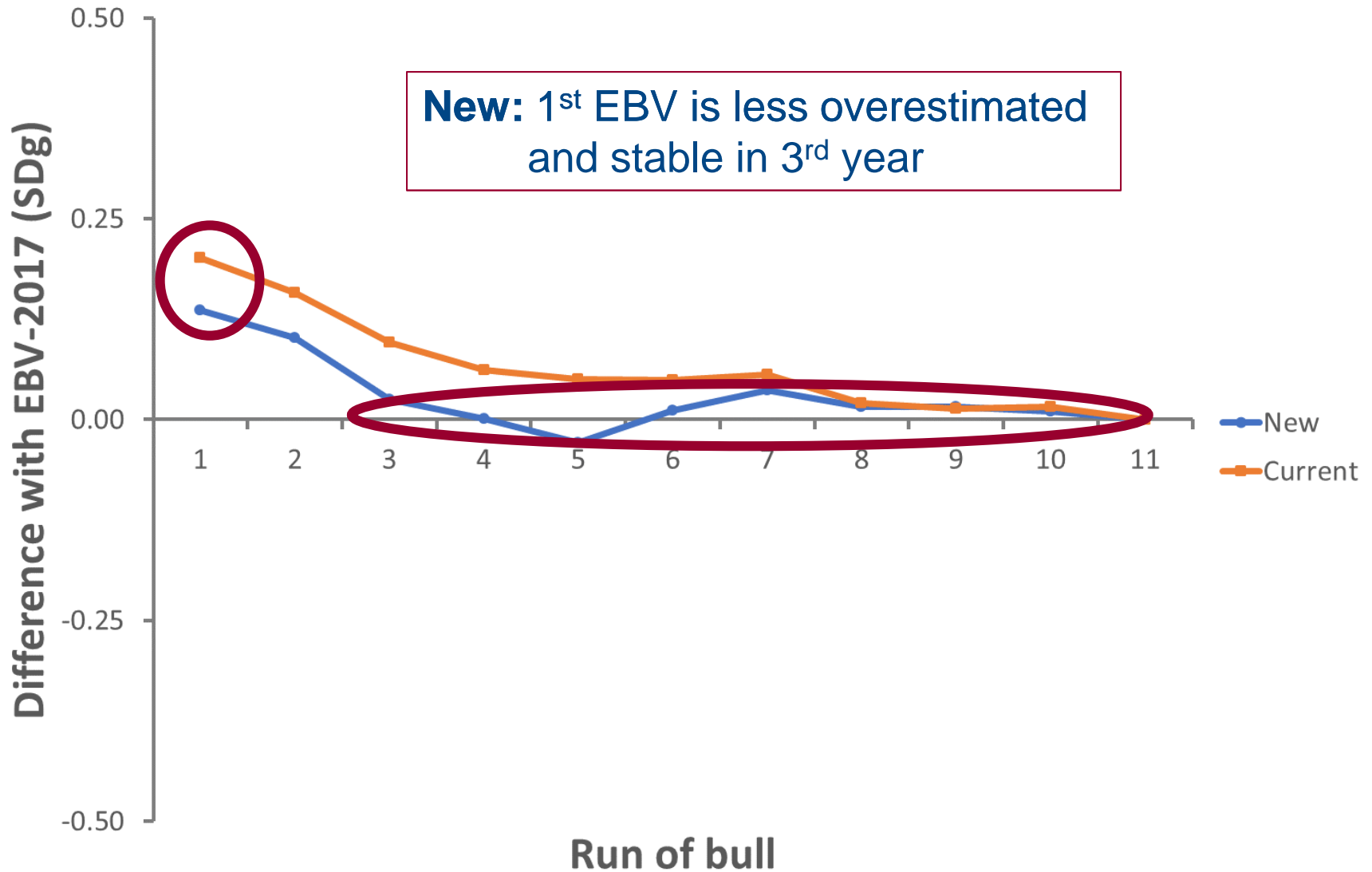
**New: Higher reliability for bulls with incomplete information**

# Difference of n<sup>th</sup> run of bull with latest EBV for first crop bulls



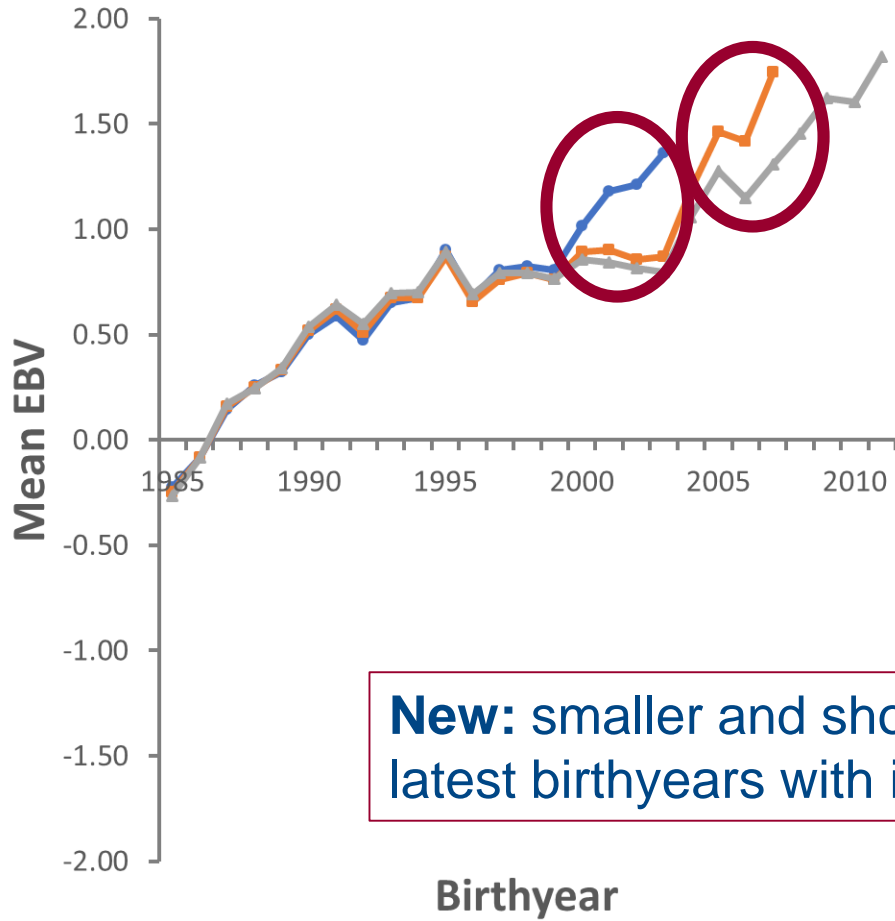


# Difference of n<sup>th</sup> run of bull with latest EBV for second crop bulls

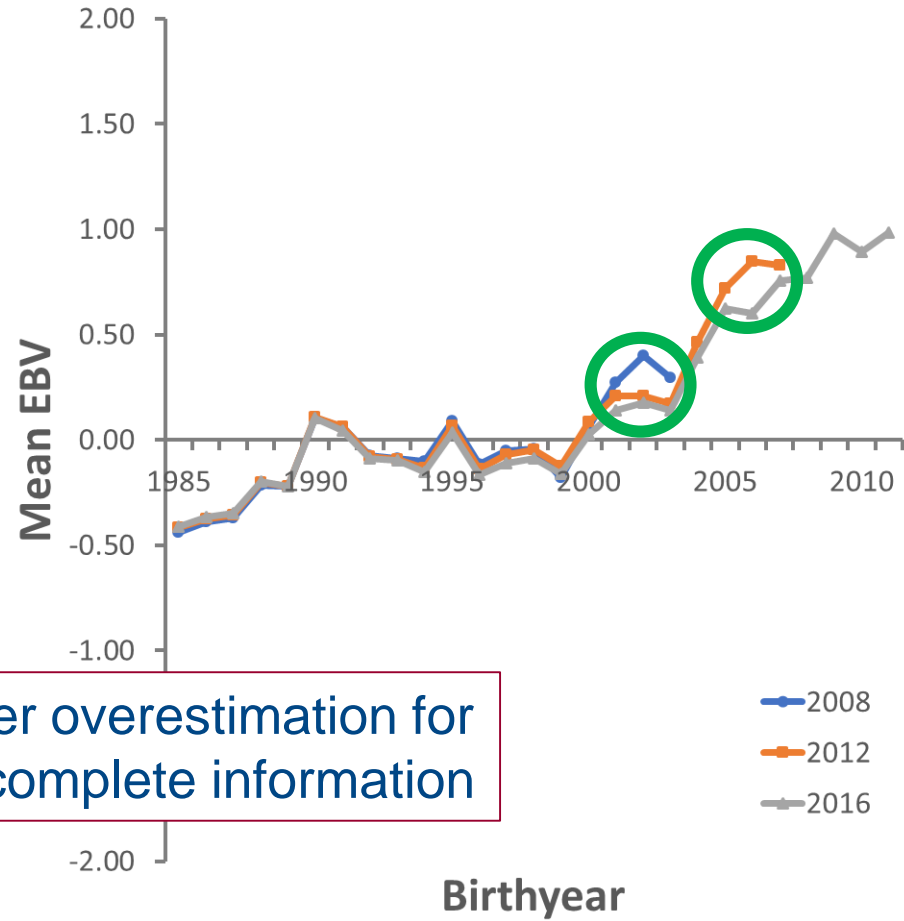


# Genetic trends

## Current



## New



**New:** smaller and shorter overestimation for latest birthyears with incomplete information

- 2008
- 2012
- 2016

# Correlations between first EBV and later EBV

EBV run	First crop bulls		
	current	new	difference
1	1.00	1.00	0.00
2	0.83	0.86	+0.03
3	0.75	0.77	+0.03
4	0.68	0.73	+0.05
5	0.65	0.72	+0.07
6	0.63	0.71	+0.09
7	0.61	0.71	+0.10
8	0.59	0.70	+0.12
9	0.58	0.70	+0.12
10	0.59	0.69	+0.10
11	0.63	0.71	+0.08

Correlations between runs higher with **new** → less reranking

# Presentation of new breeding value

- Current EBV is for productive longevity
  - New EBV should be comparable with current EBV
- Expand EBV based on 72 months to total life
  - Same ranking
- Convert EBV from functional to productive longevity
- Add predictor traits
  - To increase reliability
- Correlation current EBV – publishable EBV  $\sim 0.90$

# Conclusions

New genetic evaluation for longevity

- Multiple traits across cow's life
- Improved calculation of reliability
  - Information of living animals is also used
- Smaller overestimation of 1<sup>st</sup> EBV
  - More stable EBV from run to run
- Less reranking

**Thank you for  
your attention!**





# Description of compared test/proven bulls

EBV run	Test bulls		Proven bulls	
	# bulls	# daughters	# bulls	# daughters
1	2378	97	263	149
2	2152	123	255	344
3	1953	126	235	436
4	1769	127	203	511
5	1567	126	170	1051
6	1341	125	139	2347
7	1284	125	111	3611
8	1089	124	88	4572
9	847	126	61	4372
10	573	134	44	4806
11	290	140	21	5525