Analysis of different definitions of performance traits in riding horses

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Background

❑ Integrated genetic evaluation in Germany is based on results of mare / stallion performance tests, young horse competitions, and **competition performance in show jumping and dressage** *(von Velsen-Zerweck, 1999)*

→ as transformed rank (repeated observations) *(Hassenstein, 1998)*

→ very low heritabilities (dressage h²=0.08, show jumping h²=0.04)

→ definition and comparative analyses of alternative traits

Material

- results of dressage and show jumping competitions in Germany between 1995-2014
- data sources: German national federation (FN) through vit

	Number of performances	**Number of horses**
Dressage	4,582,191	221,132
Show jumping	9,997,439	253,945

Highest level achieved

❑ highest performance in competition

❑ continous trait allowing distinction between winners, placed horses and participants on each individual performance level

❑ minimum requirement of 3 performance records on highest levels, otherwise downgrading (next lower level)

performance level	participation	placing	win
A	1.0	1.3	1.6
L	2.0	2.3	2.6
M	3.0	3.3	3.6
S	4.0	4.3	4.6
S**	5.0	5.3	5.6
S***	6.0	6.3	6.6

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Methods

- ASReml *(Gilmour et al., 2009)*
- linear animal models
- additive relationship matrix

I $\quad y_{ijkl} = \mu + Sex_i + Age_j + Year_k + animal_l + e_{ijkl}$

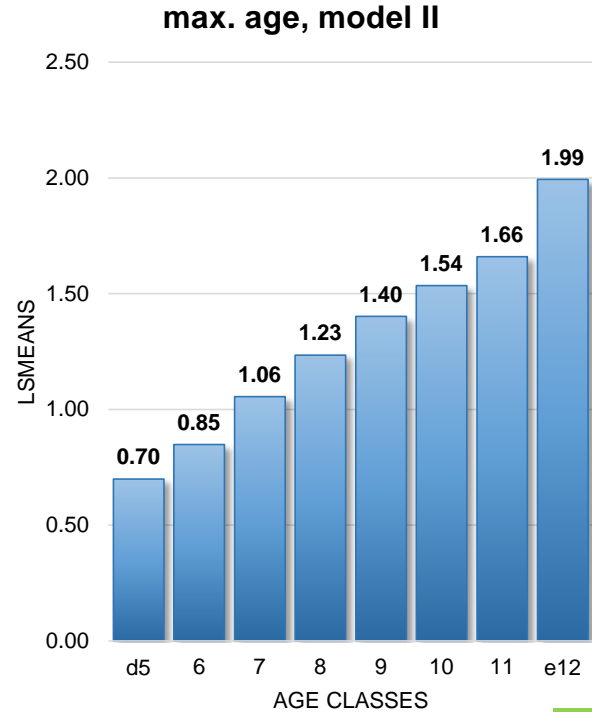II $\quad y_{ijkl} = \mu + Sex_i + max.\ Age_j + Year_k + animal_l + e_{ijkl}$

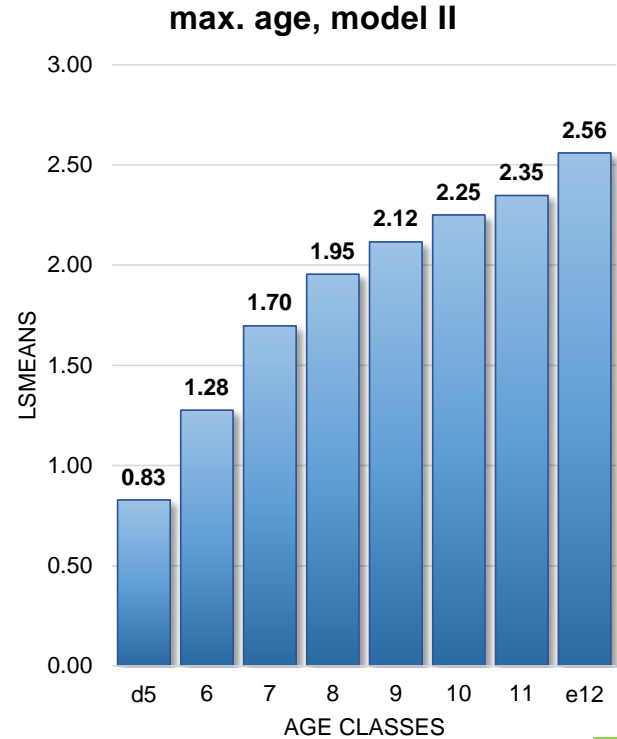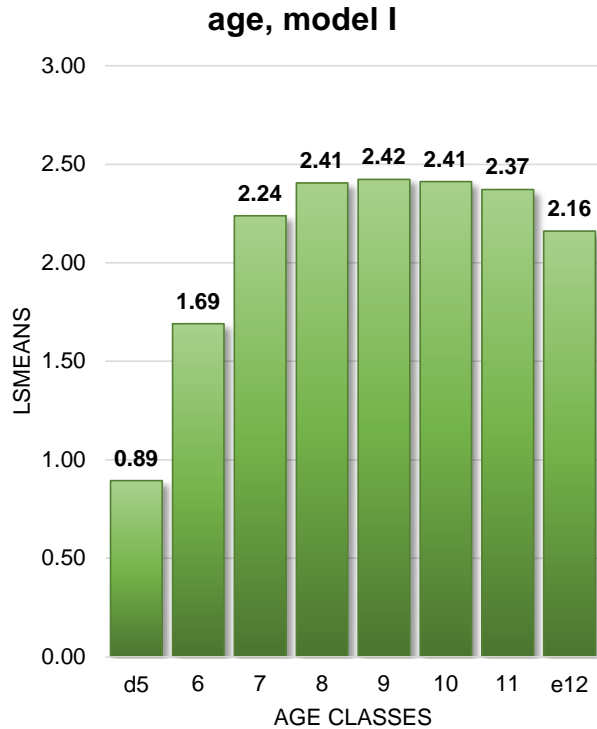| age at the highest performance | maximum age in competition data |

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Genetic parameters

discipline	model	σ^2_a	σ^2_e	σ^2_p	h^2	se_{h^2}
Dressage	I	0.235	0.743	0.978	0.240	0.006
	II	0.220	0.732	0.952	0.231	0.006
Show jumping	I	0.328	0.711	1.039	0.316	0.006
	II	0.358	0.674	1.033	0.347	0.006

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LSMeans Dressage

age, model I

max. age, model II

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LSMeans Show jumping

age, model I

max. age, model II
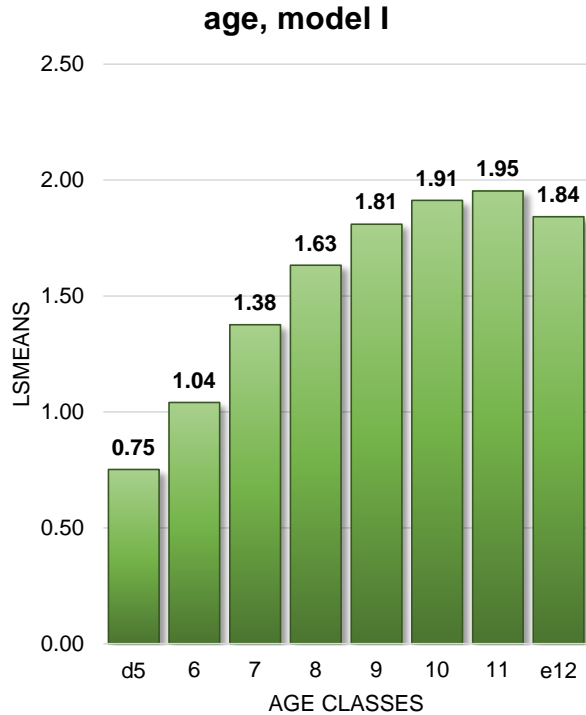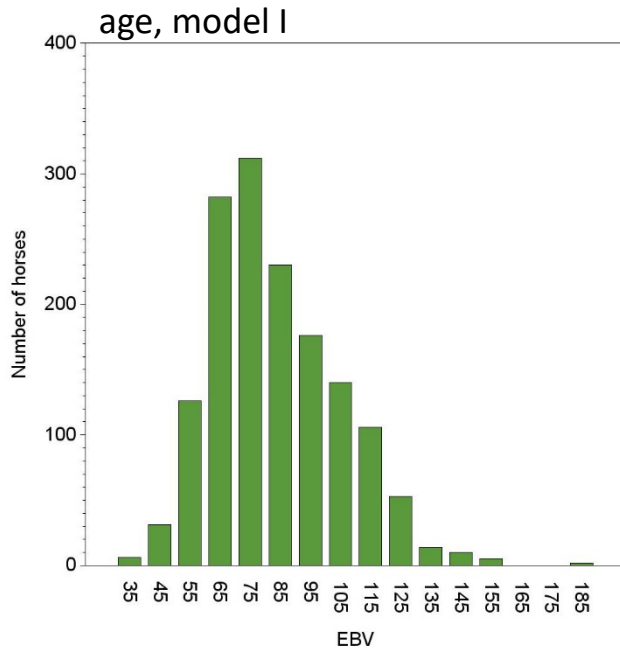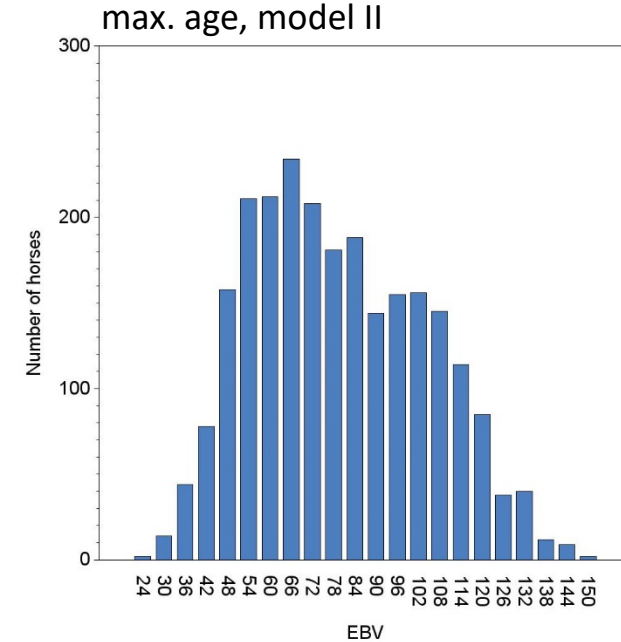
Distribution of EBVs for stallions: Dressage

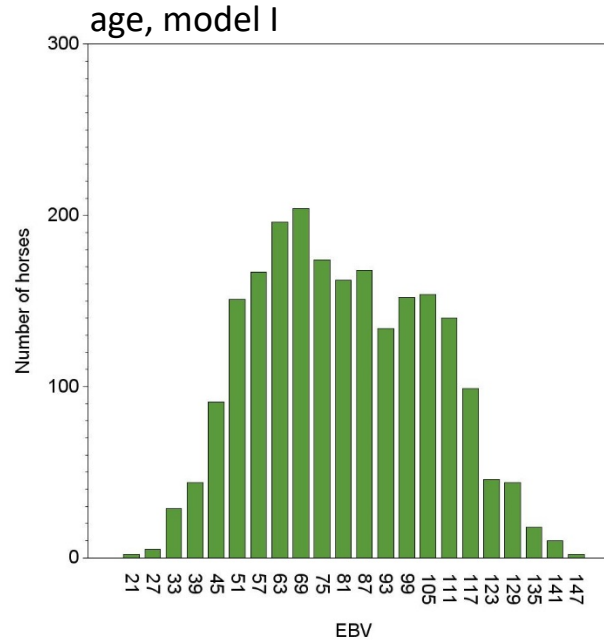**Base population:**
stallions with birth year 2002-2006 and own performance in dressage or at least 5 competing offspring (N= 408)

age, model I

max. age, model II
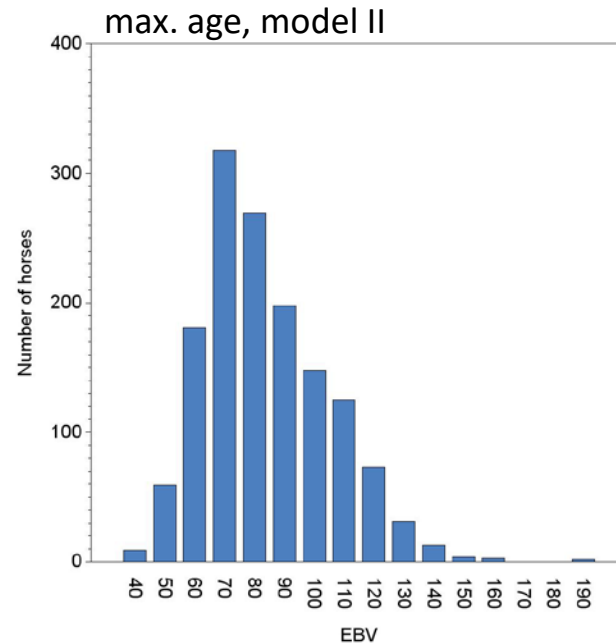
Model	N	Mean	SD	Min	Max
I (age)	1,493	83.29	21.25	33	185
II (max. age)	1,433	84.07	20.97	36	191

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Distribution of EBVs for stallions: Show jumping

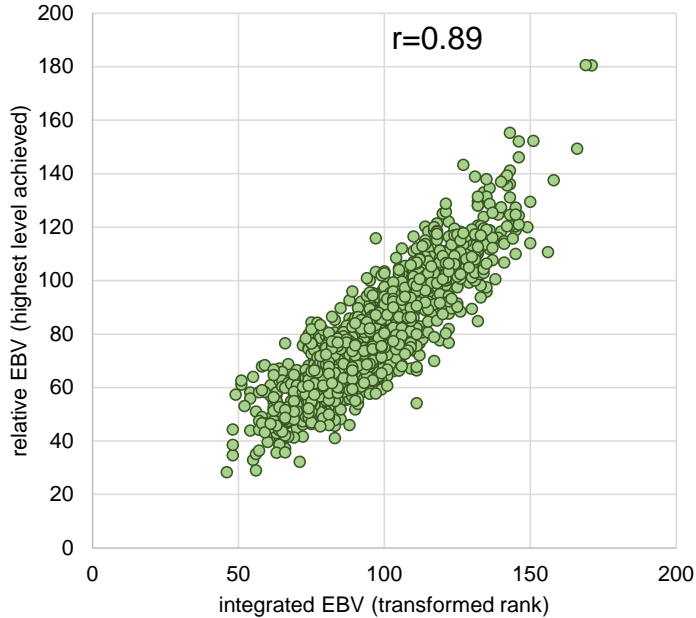**Base population:**
stallions with birth year 2002-2006 and own performance in show jumping or at least 5 competing offspring (N= 532)

Model	N	Mean	SD	Min	Max
I (age)	2,192	81.03	24.41	21	149
II (max. age)	2,430	79.51	24.62	23	152

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Highest level achieved vs. transformed rank (Dressage)

age, model I
N=1,478

r=0.89

relative EBV (highest level achieved)

integrated EBV (transformed rank)

stallions with EBV
reliabilities
of at least 75%
in both evaluations

max. age, model II
N=1,420

r=0.87

relative EBV (highest level achieved)

integrated EBV (transformed rank)

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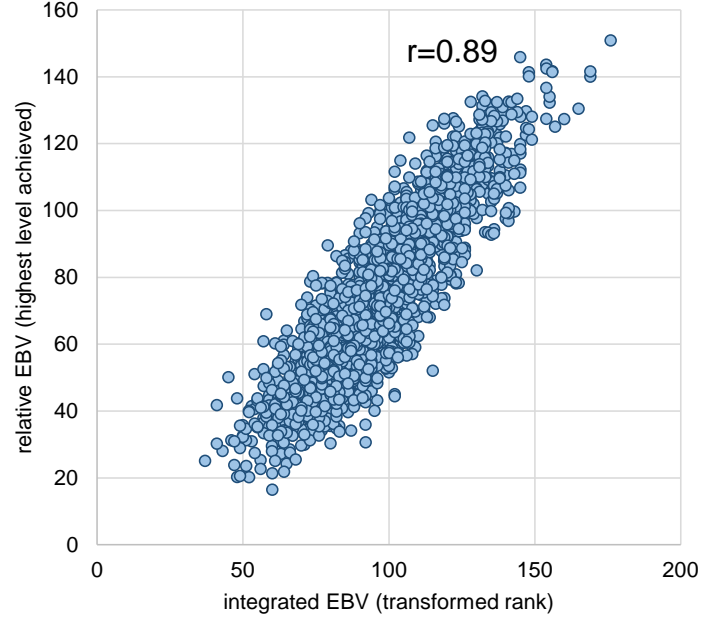Viktoria Welker *et al.*
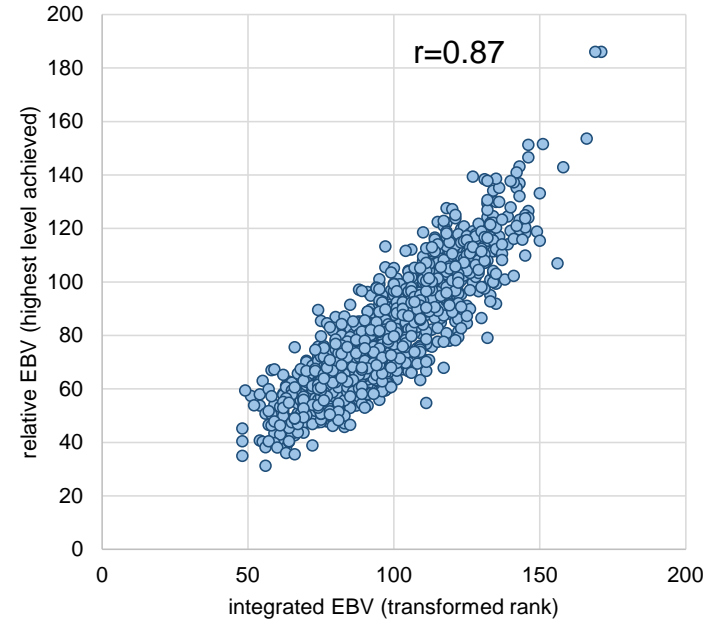
Highest level achieved vs. transformed rank (Show jumping)
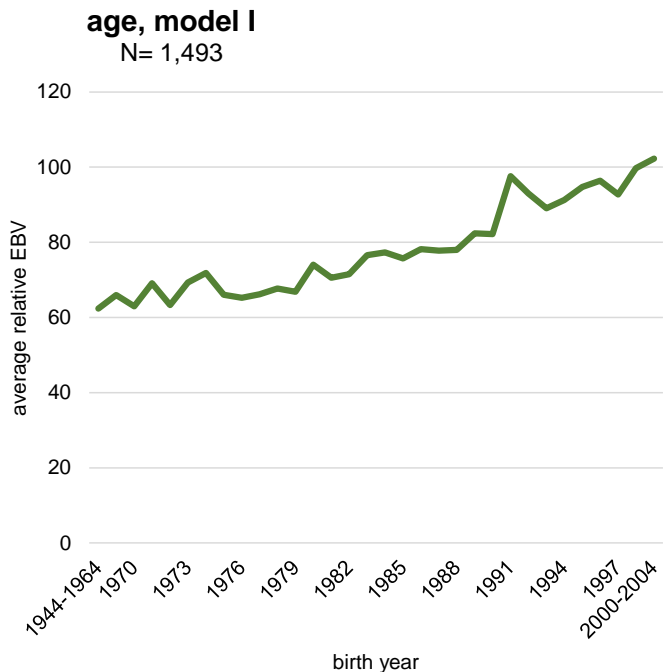
age, model I
N= 2,046

r=0.89
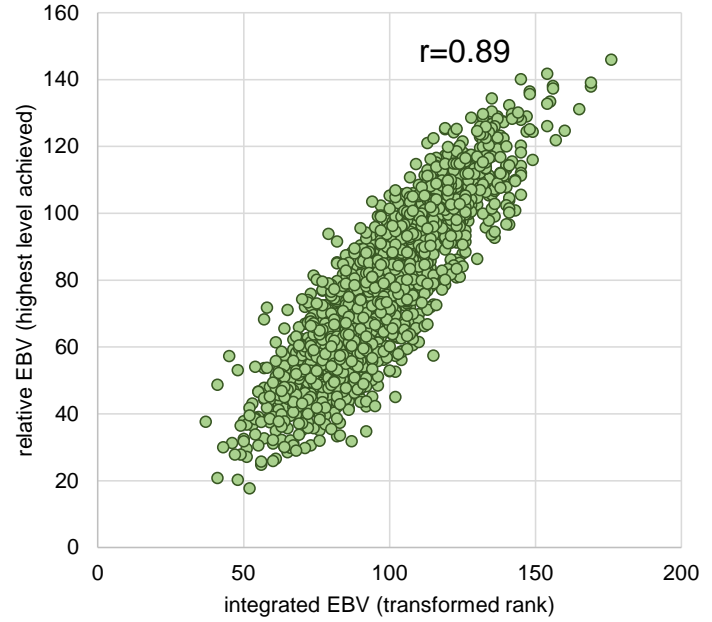
stallions with EBV
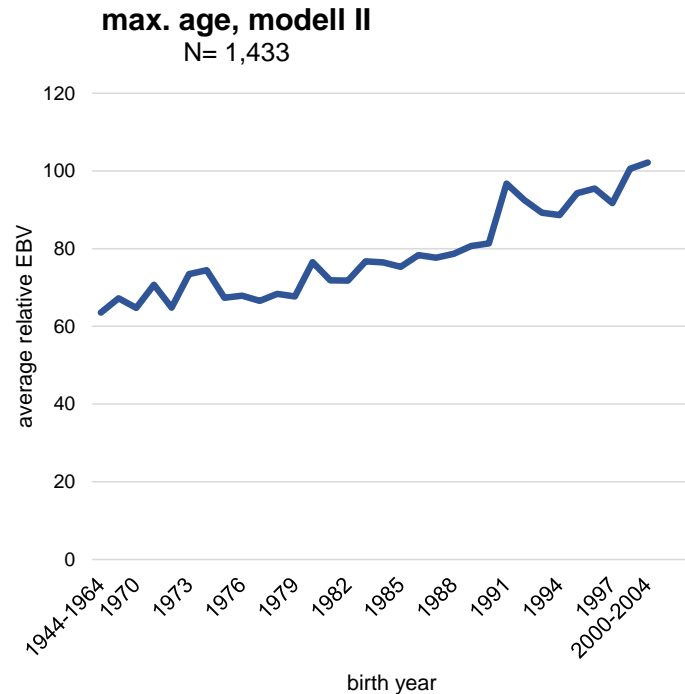reliabilities
of at least 75%
in both evaluations

max. age, model II
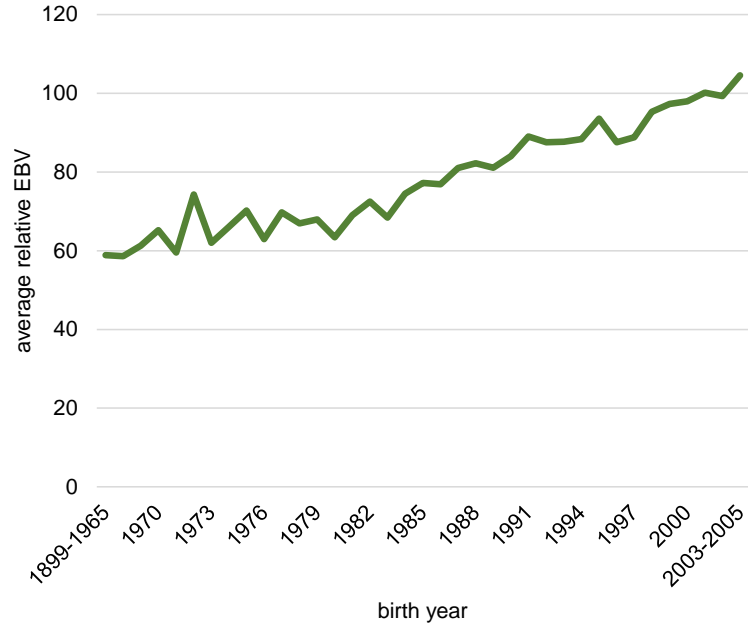N= 2,246

r=0.89

Genetic trends (Dressage)

age, model I
N= 1,493

stallions with EBV
reliabilities
of at least 75%

max. age, modell II
N= 1,433

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Genetic trends (Show jumping)

age, model I
N= 2,192

stallions with EBV
reliabilities
of at least 75%

max. age, model II
N= 2,434

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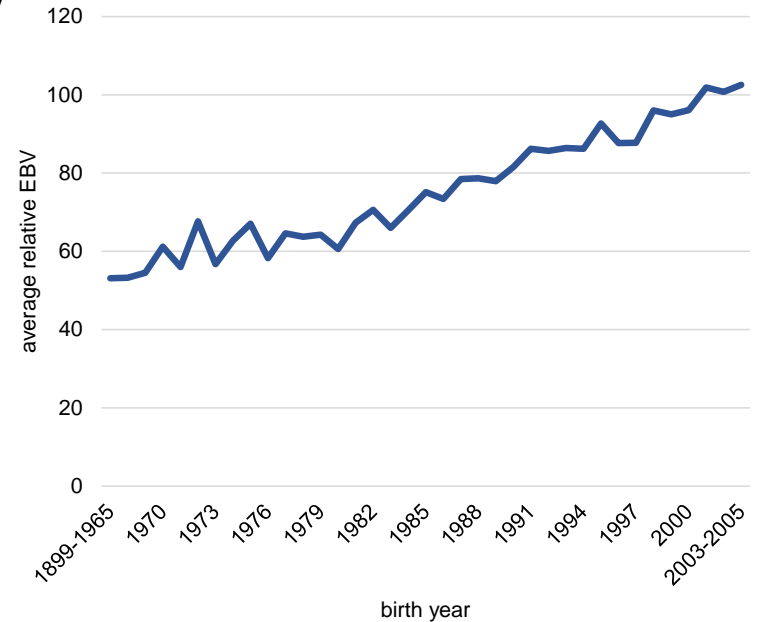
Conclusions

- similarity of results:

→ different models (alternative traits; age vs. max. age)

→ alternative traits (highest level) and routine GE traits (transformed rank)

- but: higher heritabilities → higher reliabilities

- Highest level achieved supposed to better reflect the breeding goal of sport horse breeding

- complexity of competition performance:
  age → learning (speed / shape of curve)
  max. age → potential for top level performance

- challenges of data structure
  (pre-selection, censoring, confounding between genetic and rider effect)

- prospects: integration of additional competition data (national and international)

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Thank you for your attention!

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