



Impact of Genomic Pre-selection on MACE

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WHAT ARE THE GPS EFFECTS?

Genomic pre-selection (GPS)
of bulls entering AI

$$MS \sim N(0, 1/2 \sigma_g^2)$$

Not anymore

If the national system does not
accommodate GPS effects

GPS bias in EBV

→ MACE ?



SIMULATION METHOD

To study the impact of the GPS bias on MACE,
We need to simulate GPS in MACE input



The Interbull GPS WG, February, 2018



+ Modify MACE

GPS & Future Mace WG, August, 2018

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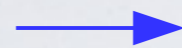
SIMULATION METHOD



SIMULATION METHOD

STEP 1: Get DRP with no GPS

DRP with the desired ΔG for all countries



Mix99 Software

A special version provided by LUKE



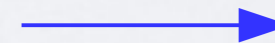
MS terms

Randomly distributed

No GPS



Mix99



First set of simulated DRP
CONTROL DATA



SIMULATION METHOD

STEP 2: Simulate GPS effects

Modify the MS terms from Step 1

- Only for one country **Cou1**
- Only for bulls with birth year \geq **2005**

Their MS terms were raised with a constant (MS+) corresponding to 10% selection intensity and 60% reliability (as in Tyrisevä et al., 2013)

On Cou1 scale: $MS+_{cou1} = SD_{gen_cou1} * i * rel$

On country Cou2 scale: $MS+_{cou2} = b_{cou1:cou2} * MS+_{cou1}$

Where $b_{cou1:cou2} = r_{g_{12}} * SD_{(BVcou2)} / SD_{(BVcou1)}$

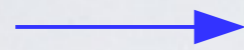


SIMULATION METHOD

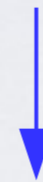
STEP 2: Simulate GPS effects

Modified MS terms

With GPS



Mix99



Second set of simulated DRP with GPS effects

GPS DATA

However: this not what we get If the country does not account for GPS effects



SIMULATION METHOD

STEP 3: Simulate GPS bias at the national level

GPS DATA

From step 2

BLUP with Birth Year fixed effect

National EBV

Biased

MACE de-regression program

New de-regressed proofs Biased

GPS_biased DATA



SIMULATION: DATA

Protein, 30 countries

Simulated DRP for all countries

- CONTROL: No GPS
- GPS: GPS effects for Cou1
- GPS_biased: GPS bias for Cou1

Simulated National EBV for Cou1

- EBV_0: Before GPS
- EBV_true: GPS effects
- EBV_biased: GPS bias

*Current Scenario: GPS effects exist only in Cou1
Cou1 has GPS bias*

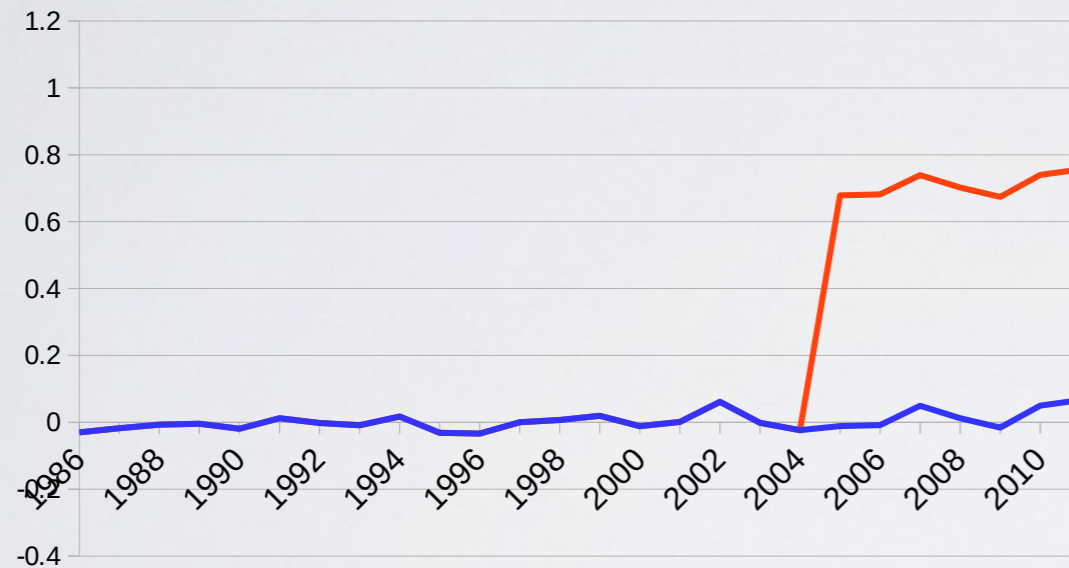


SIMULATION: RESULTS

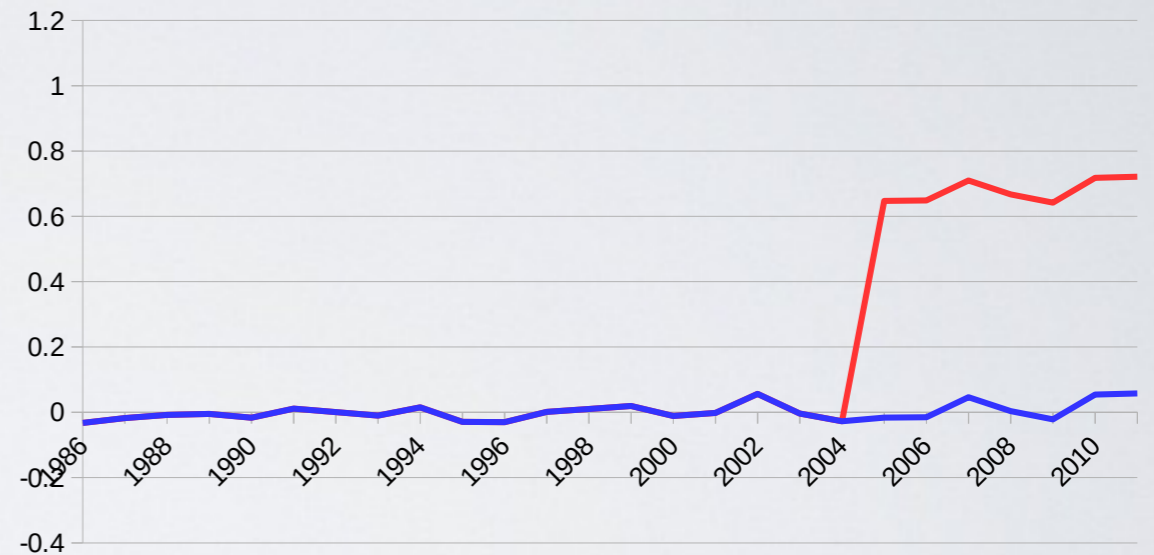
MS MEANS

MS+ on COU1 scale=0.69
MS+ on COU2 scale=0.66
 $r_G[\text{COU1}, \text{COU2}] = 0.89$

MS Cou1 bulls on Cou1 scale



MS COU1 bulls on COU2 scale



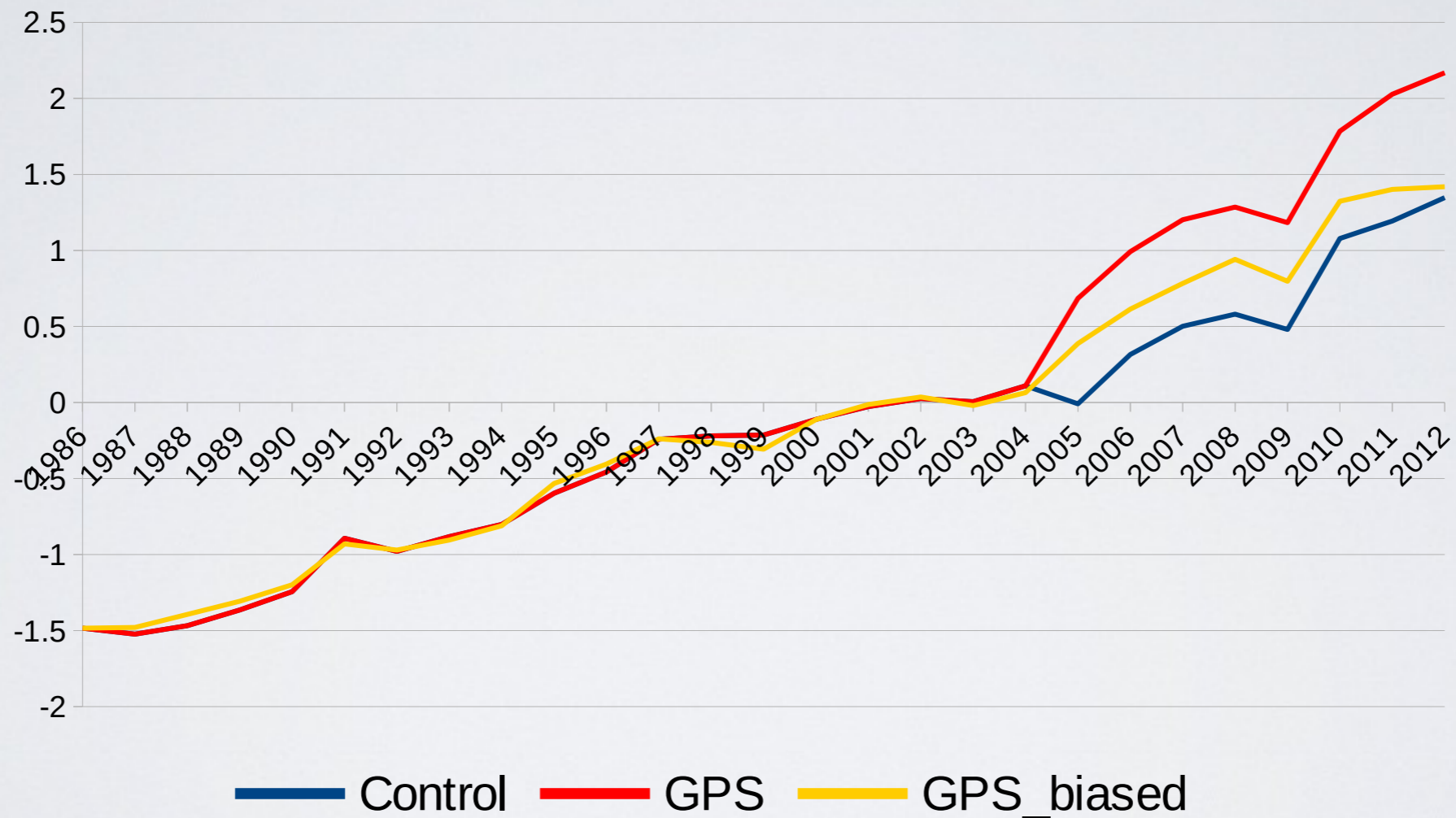
— MS_mod — MS



SIMULATION: RESULTS

DRP

DRP COU1 bulls on COU1 scale

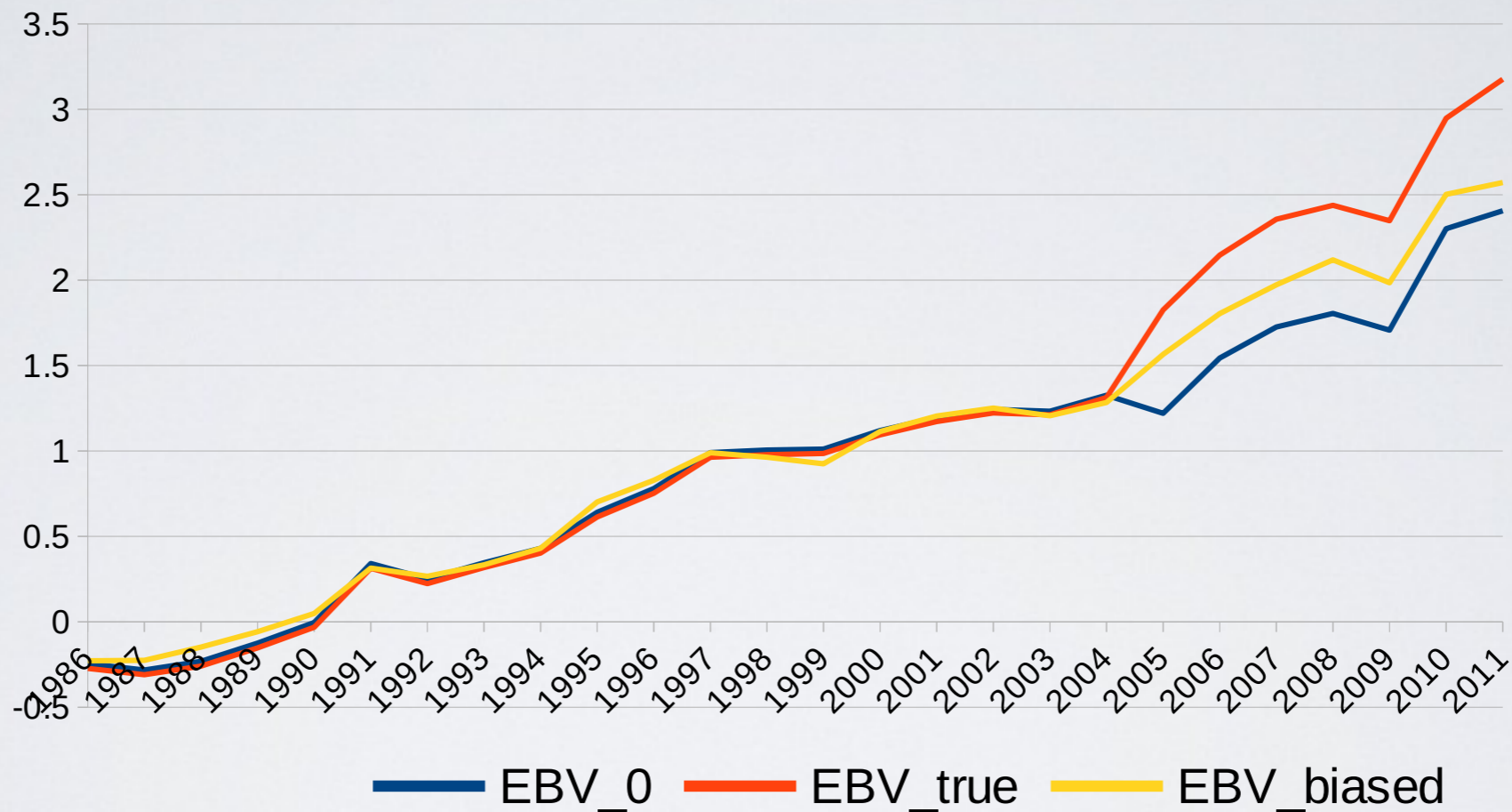




SIMULATION: RESULTS

National EBV cou1

ΔG COU1 bulls



$$GPS \text{ bias} = \text{Prediction error} = EBV_biased - EBV_true$$



IMPACT ON MACE

Three MACE Evaluations

The three different sets of de-regressed proofs:

Control, GPS, GPS_biased

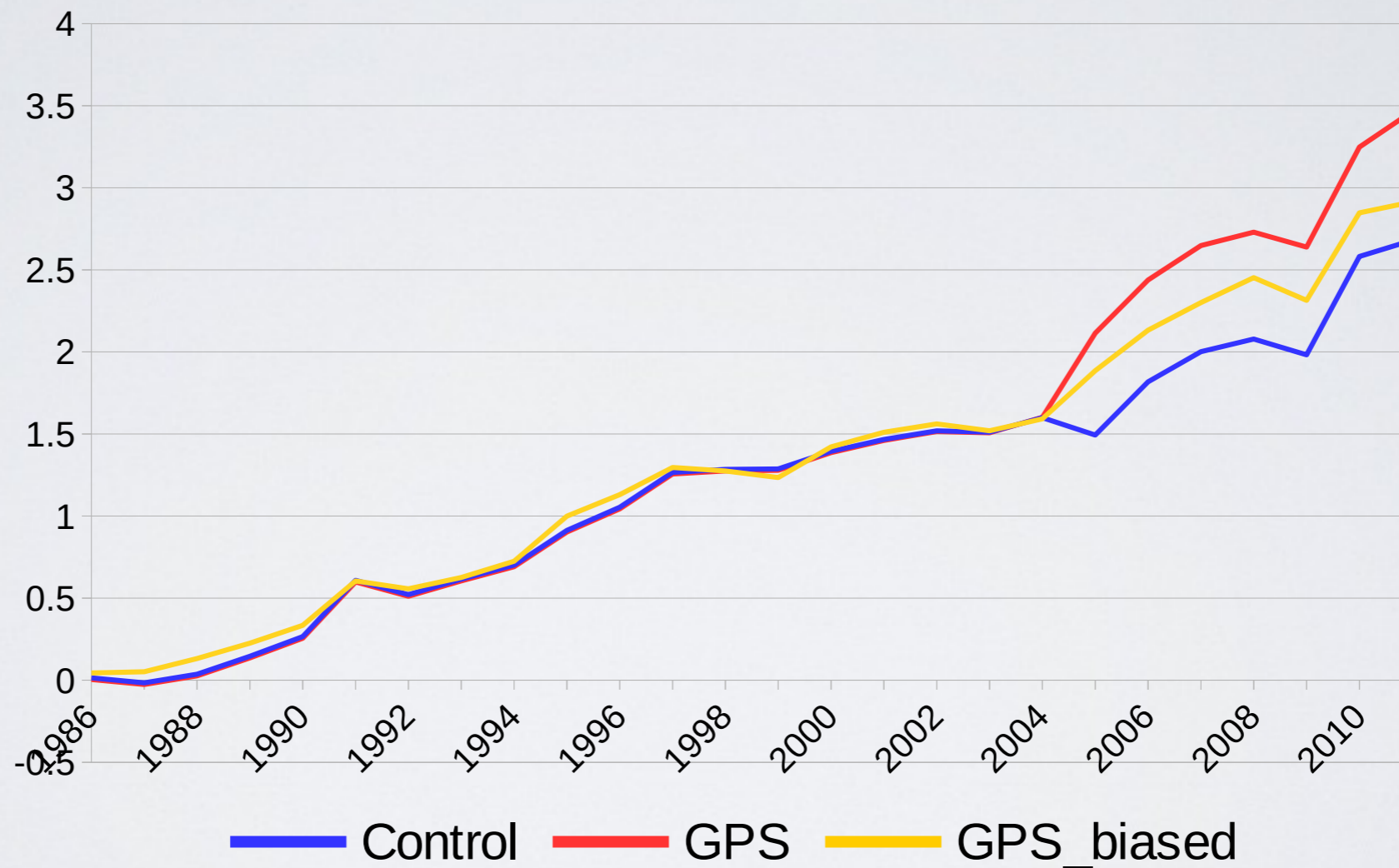
Were used as input for the current MACE system



MACE RESULTS

ON COU1 SCALE

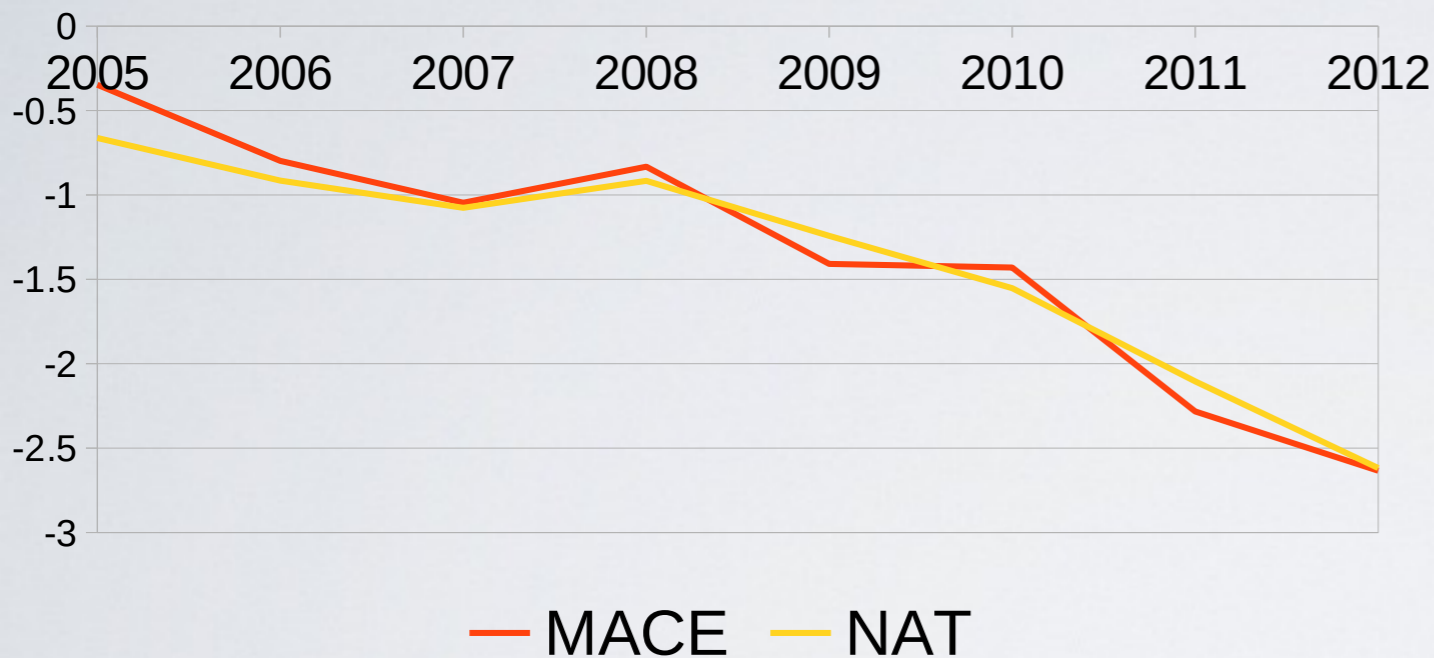
ΔG COU1 bulls



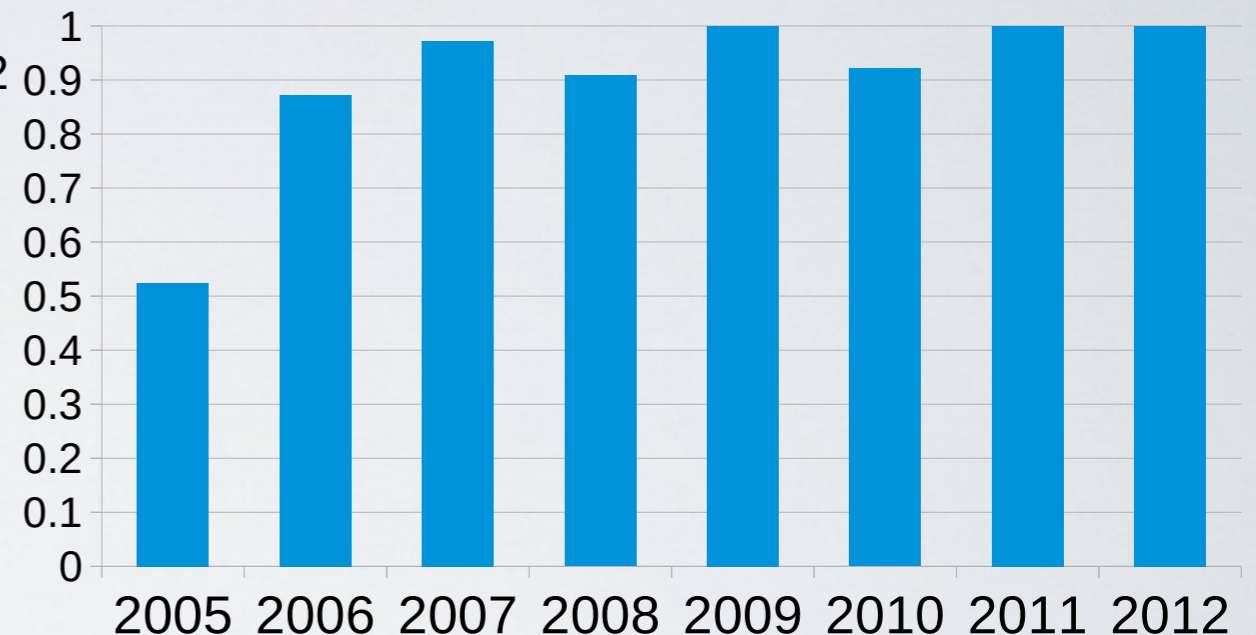


Prediction error MACE vs NAT

Prediction Error averages per year



Ratio of average PEV_MACE/PEV-NAT by Birth year

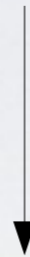


On average 92% of the GPS bias gets into MACE proofs



CONCLUSION

MACE does not accommodate the GPS bias



MACE needs to be modified