RUMM residuals and OUTFIT: Same or different?

TNO Preventie & Gezondheid

Stef van Buuren

Background

"RUMM Residuals (RR) and OUTFIT are the same, though standardized in a different way"

- **RR: mean 0, SD 1:**
  - e.g.: -2.5 < RR < +2.5
- **OUTFIT: positive, mean 1, SD more complicated:**
  - 0.5 < OUTFIT < 1.5 Linacre, 2002 – 'productive for measurement'
  - 0.9 < OUTFIT < 1.2 Schulman et al, 2001 – 'ideal range'
  - OUTFIT = Unweighted Mean Square (Masters / Wright)

Anatomy of OUTFIT / INFIT

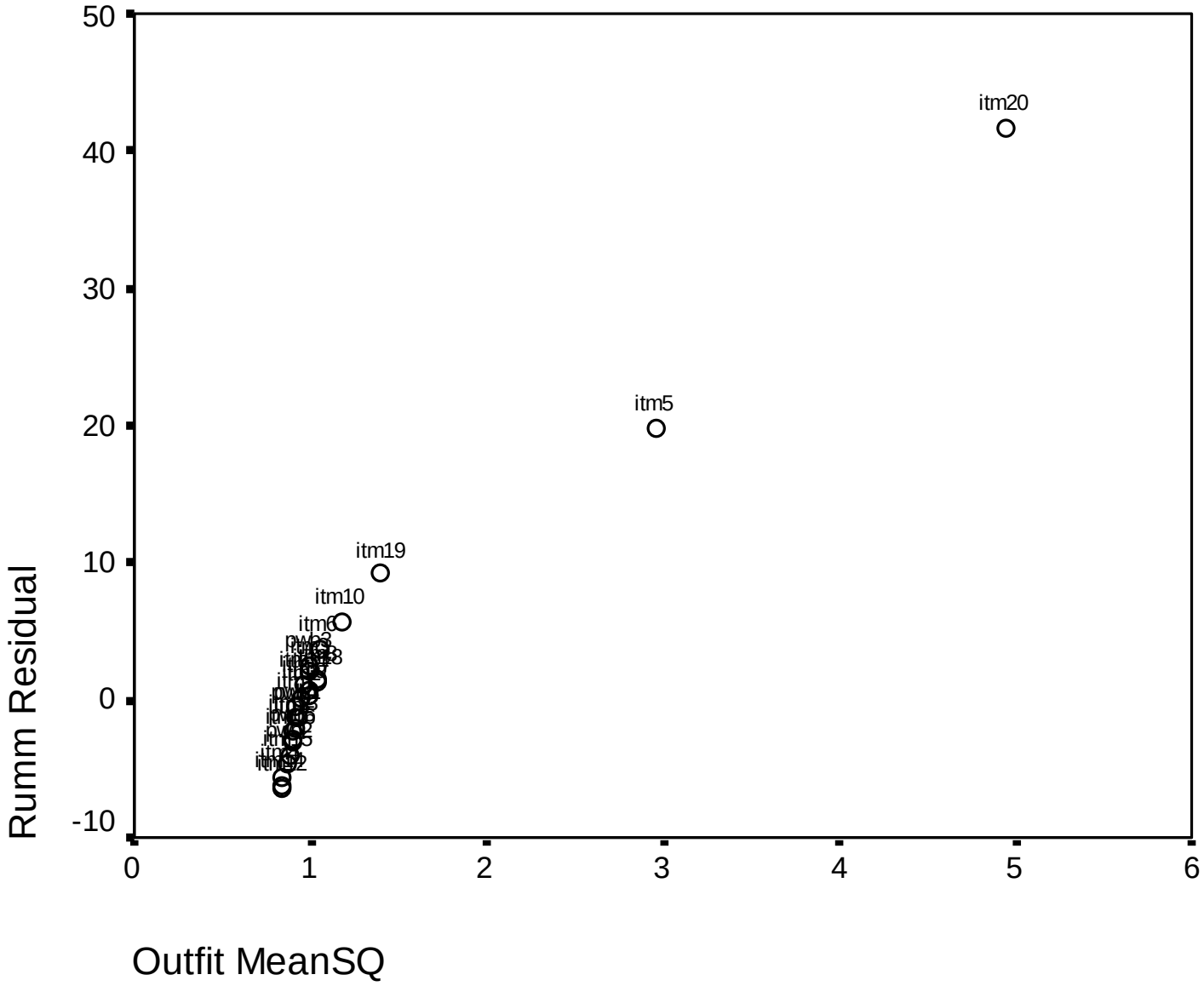
- **Score residual y:** $y = x - E$
- **Variance of y:** $s^2 = \sum_{k=0,m} (k-E)^2 P_k$
- **Standardized residual:** $z = y / s$

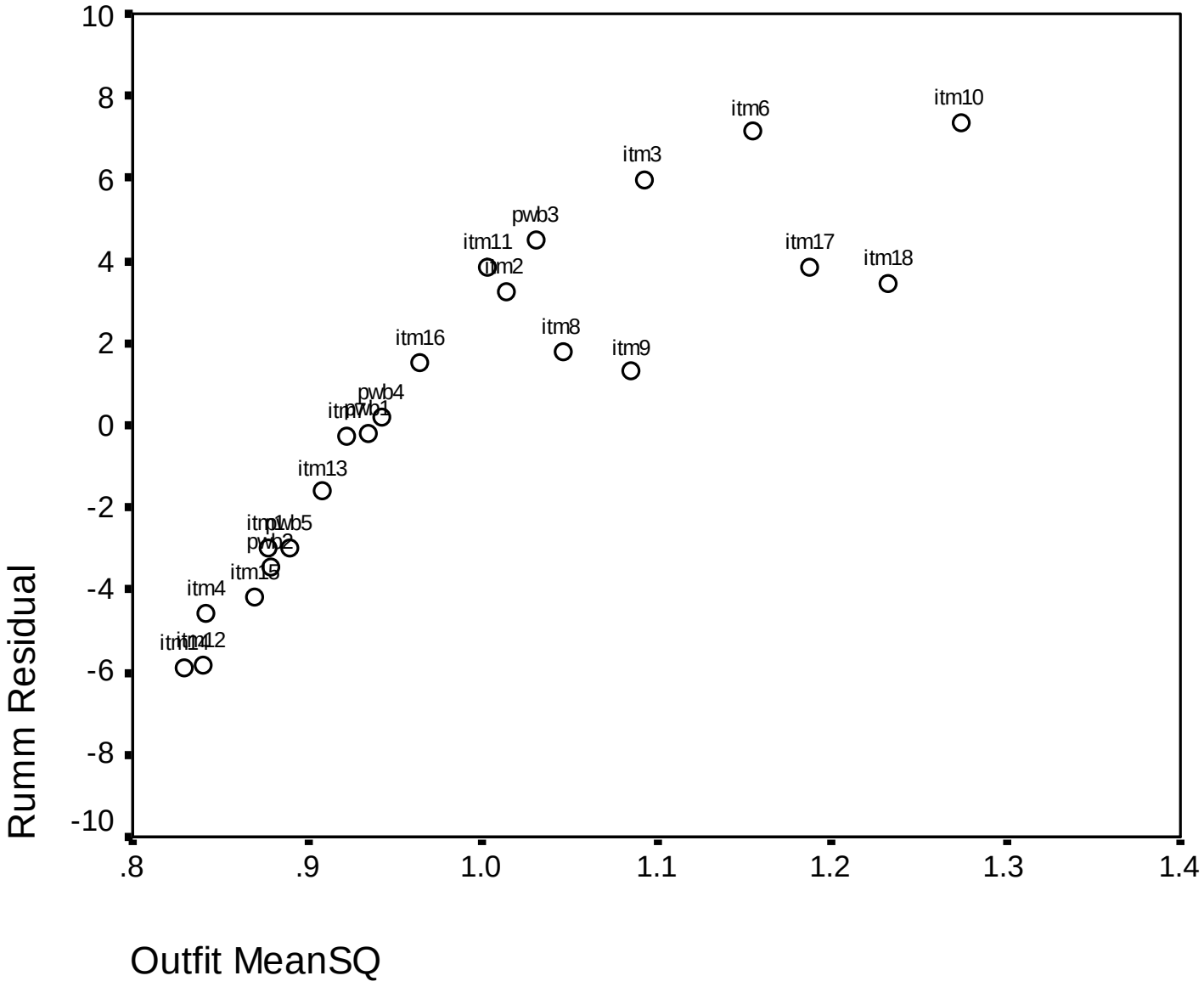
- **OUTFIT:** $\sum_{i=i,n} z_i^2 / n$
- **INFIT:** $\sum_{i=i,n} s^2_i z_i^2 / \sum_{i=i,n} s_i^2$

Practical experiences

- We observed extreme RR with large samples
- Reason to calculate OUTFIT

- EUPASS physical activity data: N ≈ 5000
- KIDSCREEN Children Quality of Life: N ≈ 7000


50
40
30
20
10
0
-10
Rumm Residual
itm20
itm5
itm19
itm10
itm6
0
1
2
3
4
5
6
Outfit MeanSQ


10
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1.4
Rumm Residual
Outfit MeanSQ
itm6
itm10
itm3
pwb3
itm11
itm17
itm18
itm2
itm8
itm16
itm9
pwb4
pwb1
itm13
pwb5
pwb2
itm15
itm4
itm12
itm14

Numerical example (KIDSCREEN)

ITEM	OUTFIT	RR
PWB1	0.959	8.859
PWB2	0.713	-5.199
PWB3	0.833	1.791
PWB4	0.746	-2.843
PWB5	0.758	-2.511

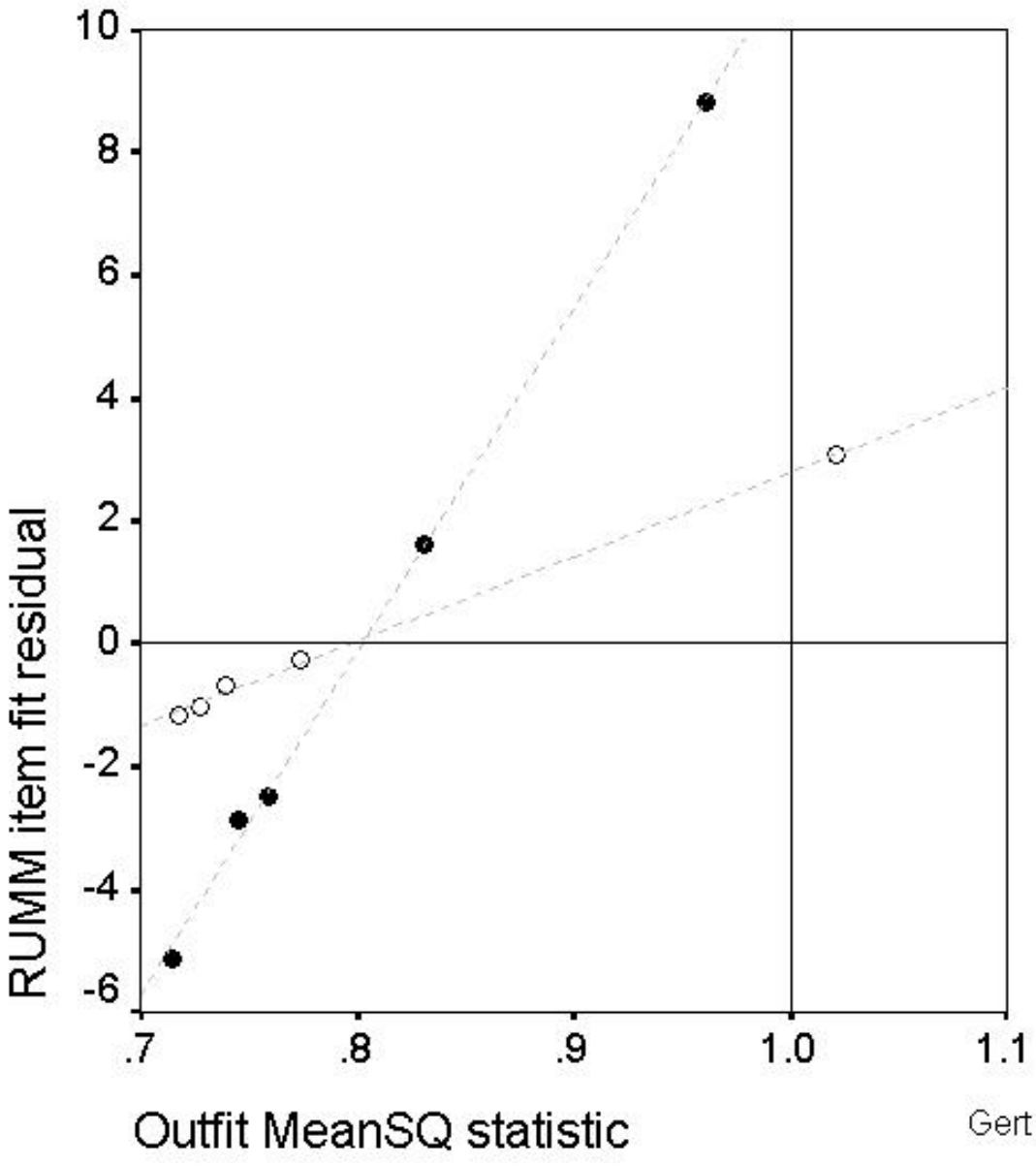
Standardised residuals were saved from RUMM 2020 using the 'Save All' option in the 'individual person-item test of fit statistics' display. SPSS was used to compute the mean squared standardised residual, the OUTFIT.

Does sample size influence the relation?

Small experiment

- **Calculate RR and OUTFIT for N=7000**
- **Calculate RR and OUTFIT for N=500 (random sample)**

- **Plot relation between RR and OUTFIT**



Gert Jacobusse and Stef van Buuren
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Questions

- **Why do RR and OUTFIT suggest opposite actions for PWB1?**
- **Why do RR shrink if a smaller sample is taken? How can we compare RR for different sample size?**
- **Why is the point of intersection located at 0.8, and not at 1.0?**