UNIVERSITY OF TECHNOLOGY SYDNEY

Measurement Error in Child Growth Modelling

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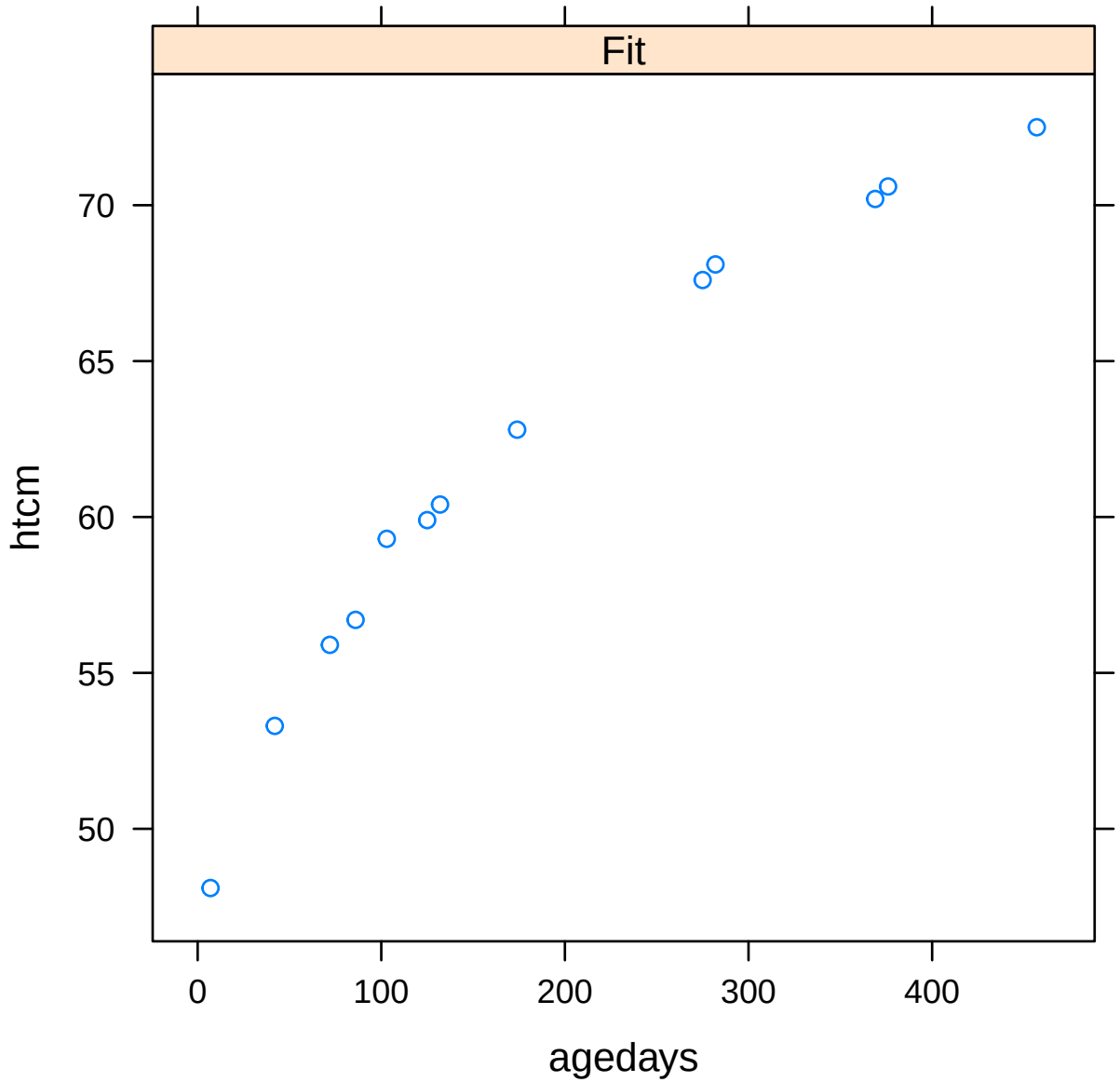
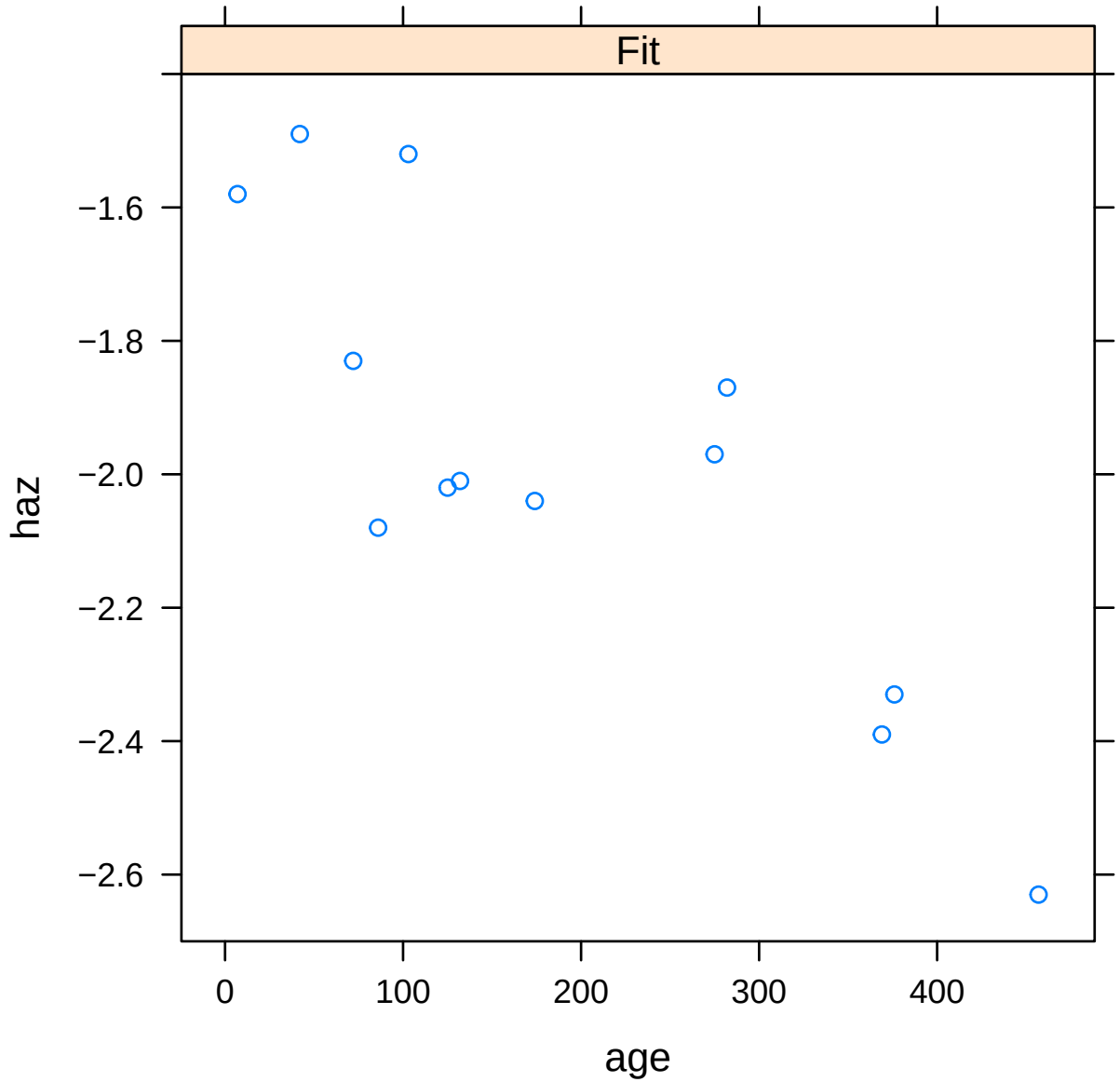
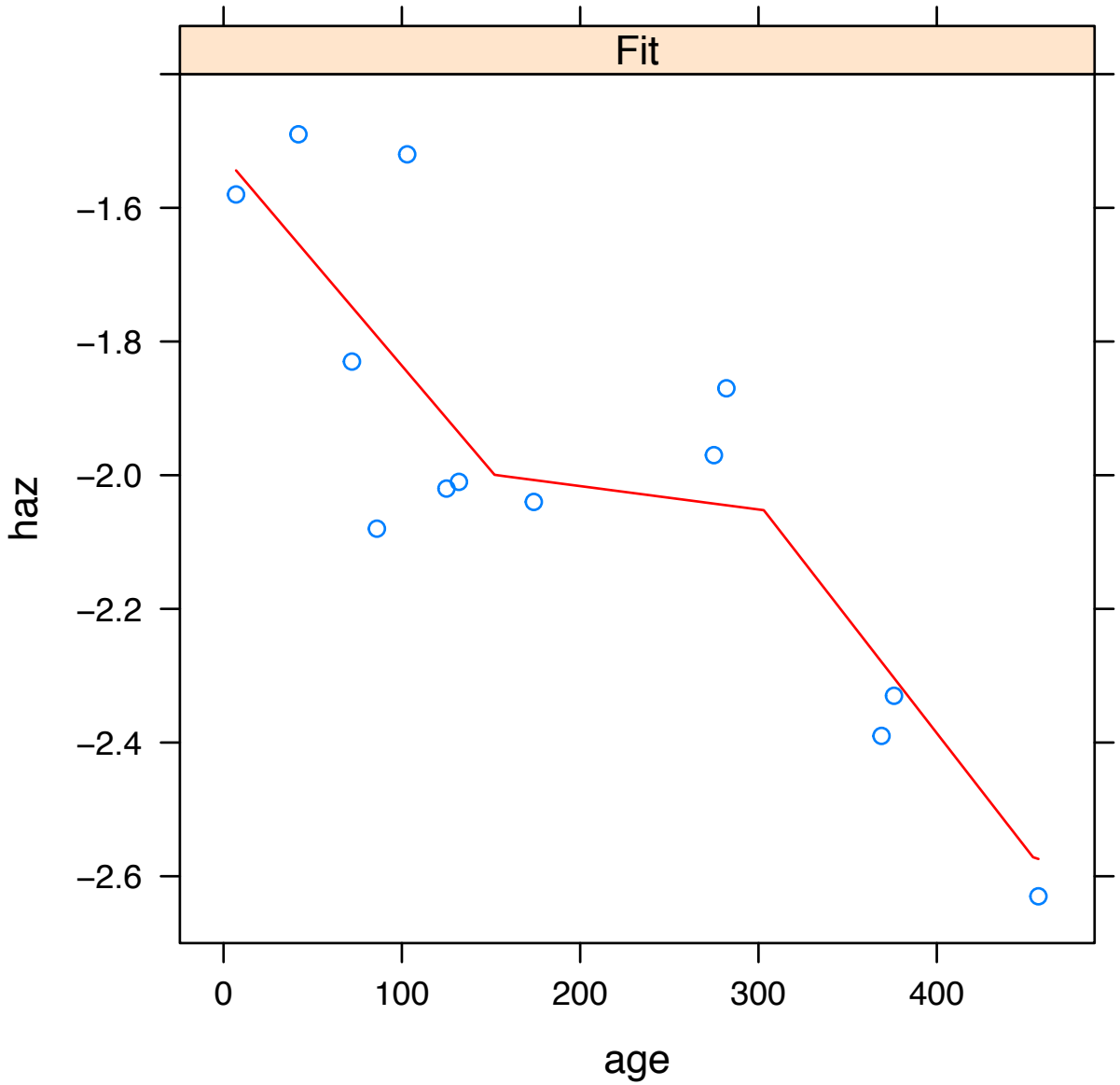
Growth Data



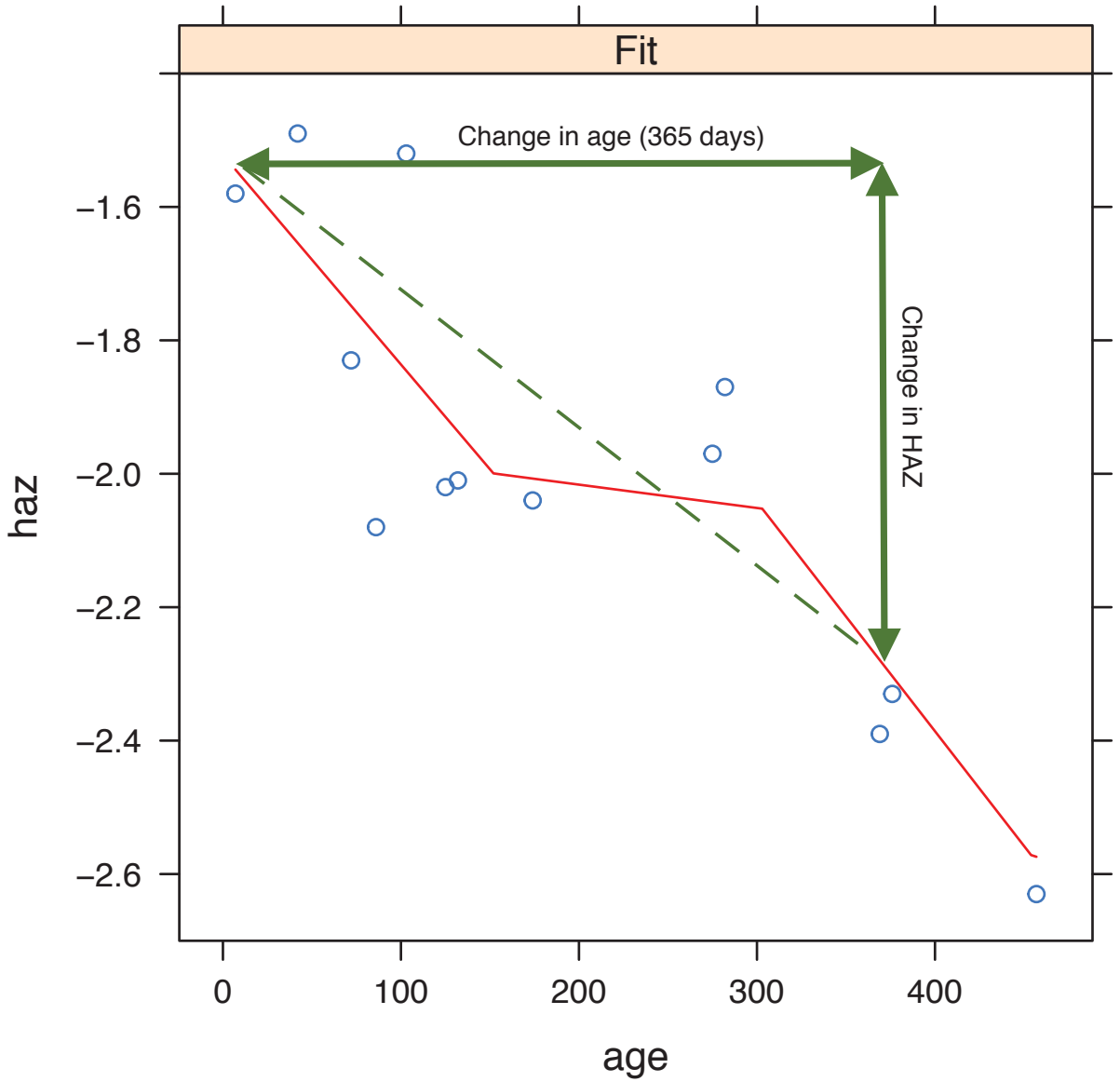
Growth Data



Fit Model



Growth Velocity

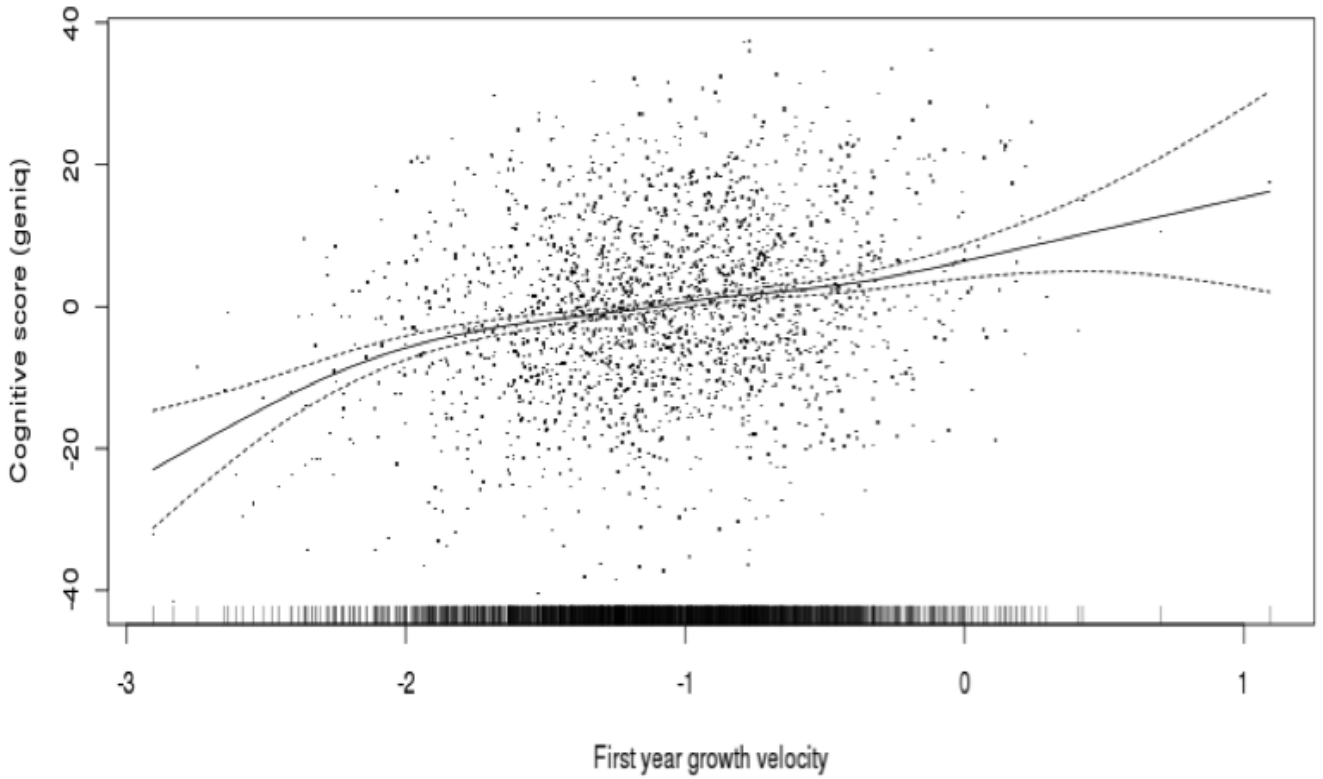


Cognition

- We wish to estimate the relationship between first year growth velocity and cognition at age 2.
  - Y_i is the Bayley's cognitive score for child i at age 2.
  - W_i is the observed first year velocity for child i.
- In reality, each observed velocity, W_i, is equal to the true velocity, X_i, plus some error.
- We are really interested in the relationship between these true velocities, X, and cognition, Y.

Simple Regression

- Exploratory analysis showed evidence of positive association between cognition, Y, and observed velocity, W.



Classical Measurement Error Model

- We propose a classical measurement error model.

$$Y_i \sim \mathrm{N}(\boldsymbol{Z_i^T}\boldsymbol{\beta_z} + X_i\beta_x, \sigma_\epsilon^2) \qquad \text{(Outcome Model)}$$

$$W_i \sim \mathrm{N}(X_i, \sigma_{u_i}^2) \qquad \text{(Measurement Model)}$$

- Knowledge of the subject-specific error term $\sigma_{u_i}^2$ is essential, but we do not have access to replicates.

- Instead, we have used bootstrapping to estimate it.

Open Questions

- Is our growth velocity measure the best way to summarise the trajectories?
- Do we even need to actively account for measurement error here?
- Is our measurement error model appropriate?
- Are there alternatives to bootstrapping for estimating the subject-specific errors?