Measuring Latent Traits with Drift Diffusion Models

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Latent Traits

- Knowledge

- Values

- Ideology

- Personality

- Multi-item scale

  - Additive index

  - Factor analysis

  - Latent class analysis

 - Structural equation modeling

Response Latency Data

- Easily collected with modern survey software

- Potentially provides valuable information about the target latent trait

  - Easy decisions (i.e., strong preferences) should be quicker

  - Difficult decisions (i.e. weak or close preferences) should take longer

Drift Diffusion Model

- First introduced by Ratcliff (1978)

- Frequently used in psychology and marketing literatures

- Useful for modeling decision processes between 2 alternatives

- Incorporates response time into estimation

Fig. 1 Realization of a four-parameter diffusion process modeling the binary decision process. *Note.* The parameters are the *boundary separation a* for two response alternatives, the *relative starting point w*, the *drift rate v*, and the *non-decision time* t_0. The decision process is illustrated as a jagged line between the two boundaries. The predicted distributions of the reaction times are depicted in blue

Reproduced from Henrich et al. 2023
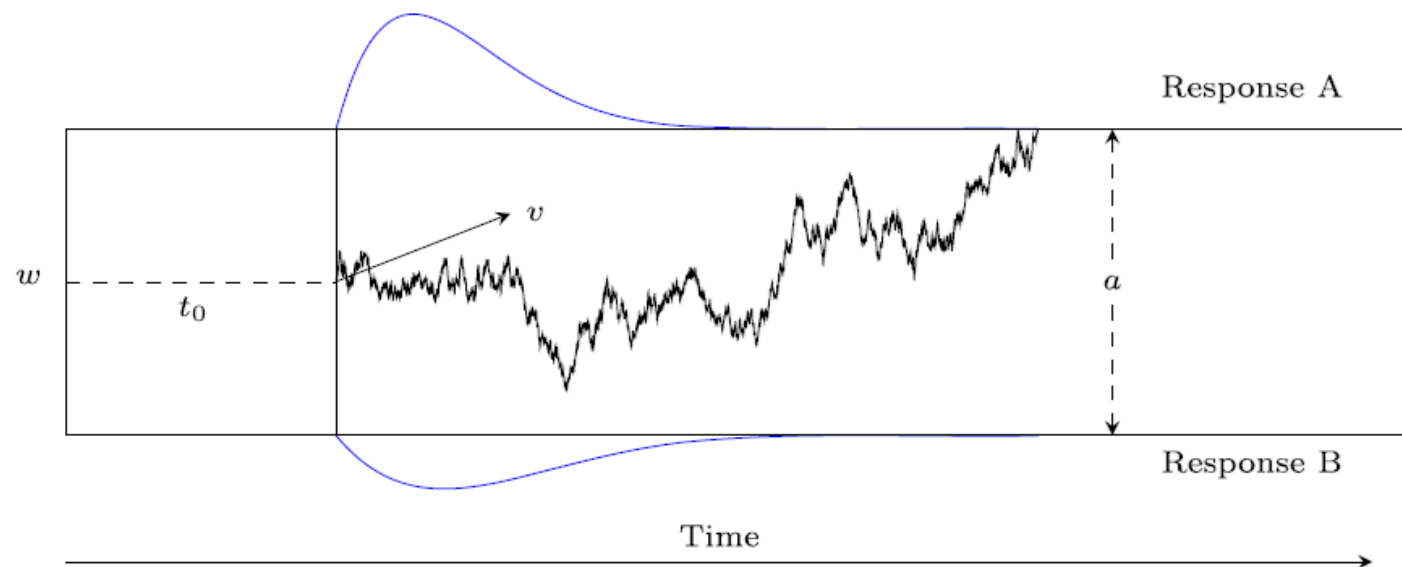
Data

- Sample
  - Recruited 1,648 U.S. adults via Lucid Marketplace
  - Fielded 2024 June 1-7
  - Analysis sample n = 1,531 respondents
- Measures
  - Knowledge: 15 political knowledge items displayed in random order
  - Values: 30 decision tasks with binary choice between random 2 (of 49) values
  - Response time collected for each knowledge item or value decision
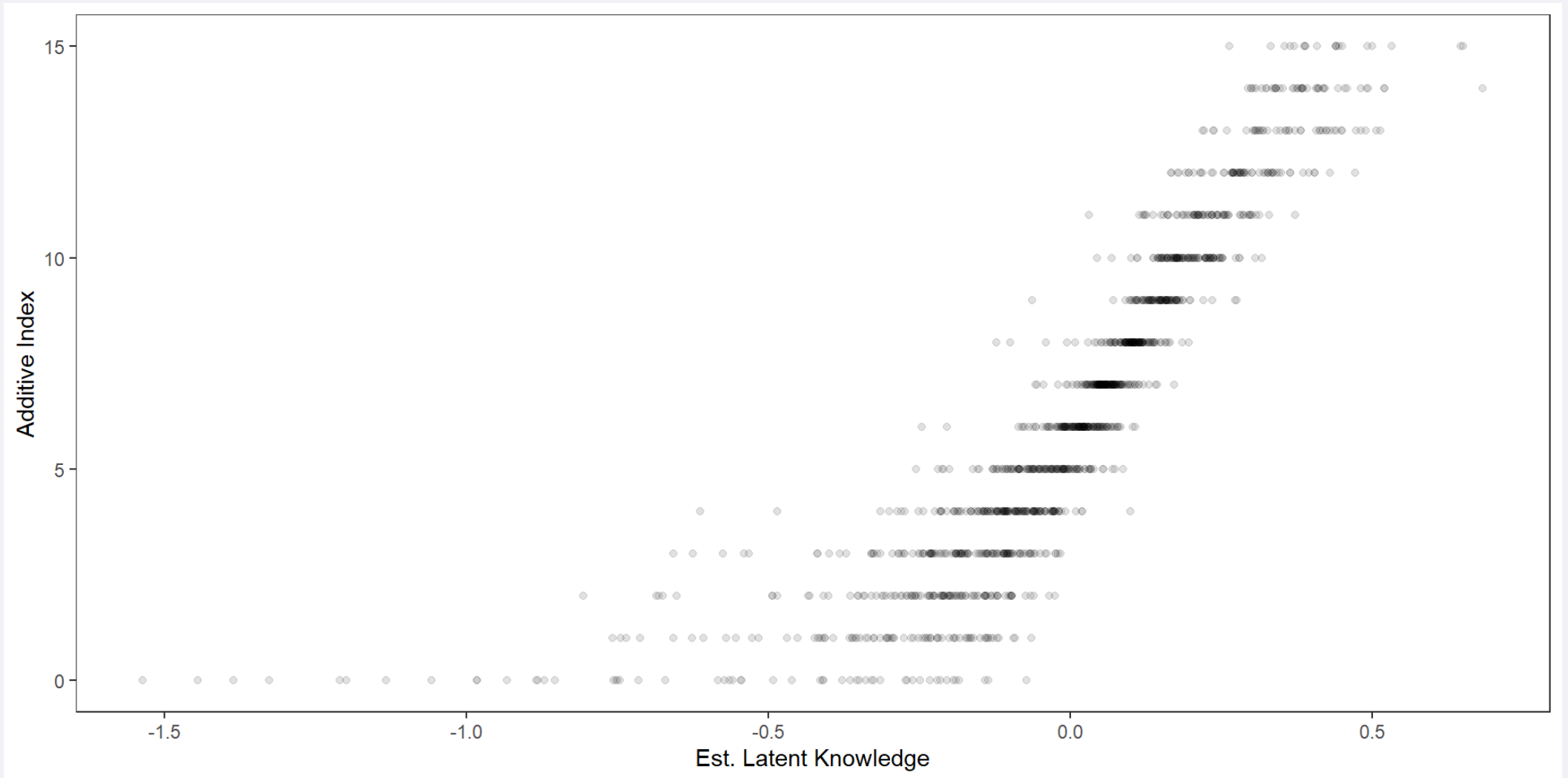
Knowledge

Knowledge Items

| Item	Correct (%)	Item	Correct (%)
State Governor Party	75.9	*Identify Vice President*	38.0
Bill of Rights	70.6	*Filibuster Chamber*	37.2
State Legislature Control	61.2	*Senate Term Length*	34.4
SCOTUS Term length	60.7	*Electoral College Tie*	25.7
Veto Override Margin	52.0	*Balance of SCOTUS*	20.8
Identify House Speaker	47.2	*Identify UK Prime Minister*	19.1
Freedom of Religion	44.5	*Identify Fed Chair*	18.6
Identify Chief Justice	40.1	*Catch Question*	6.0*

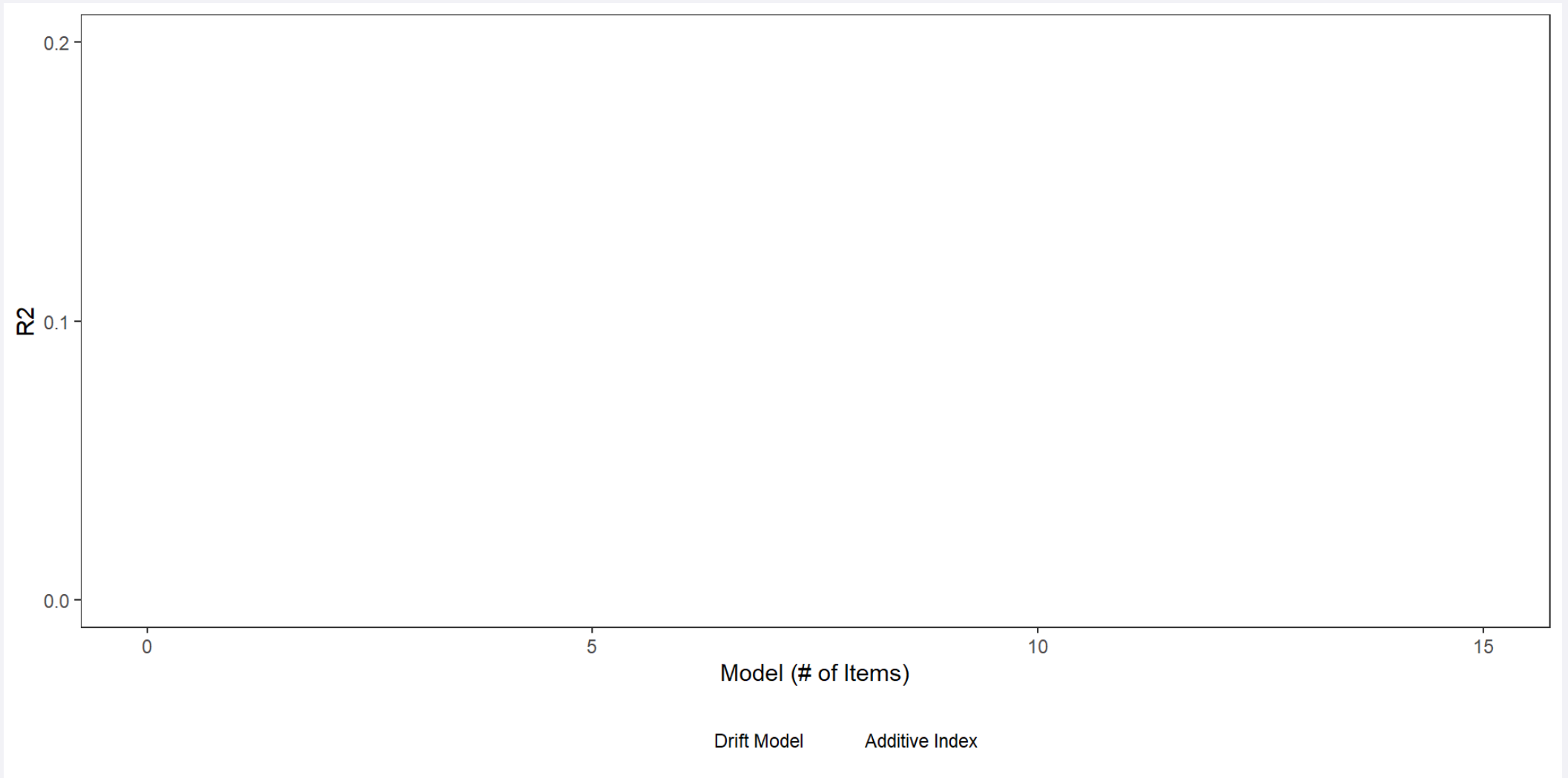# Distribution of Response Times
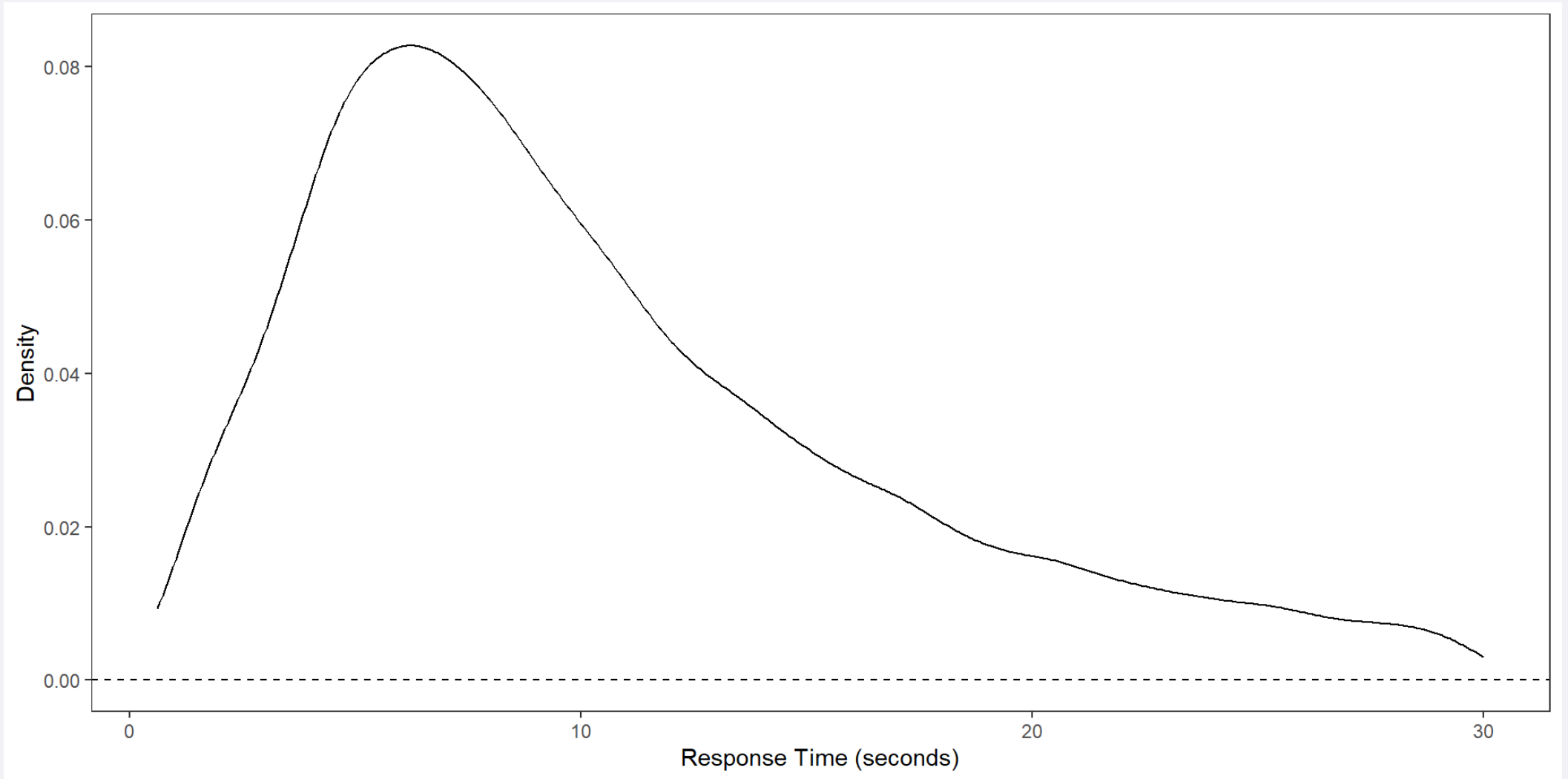
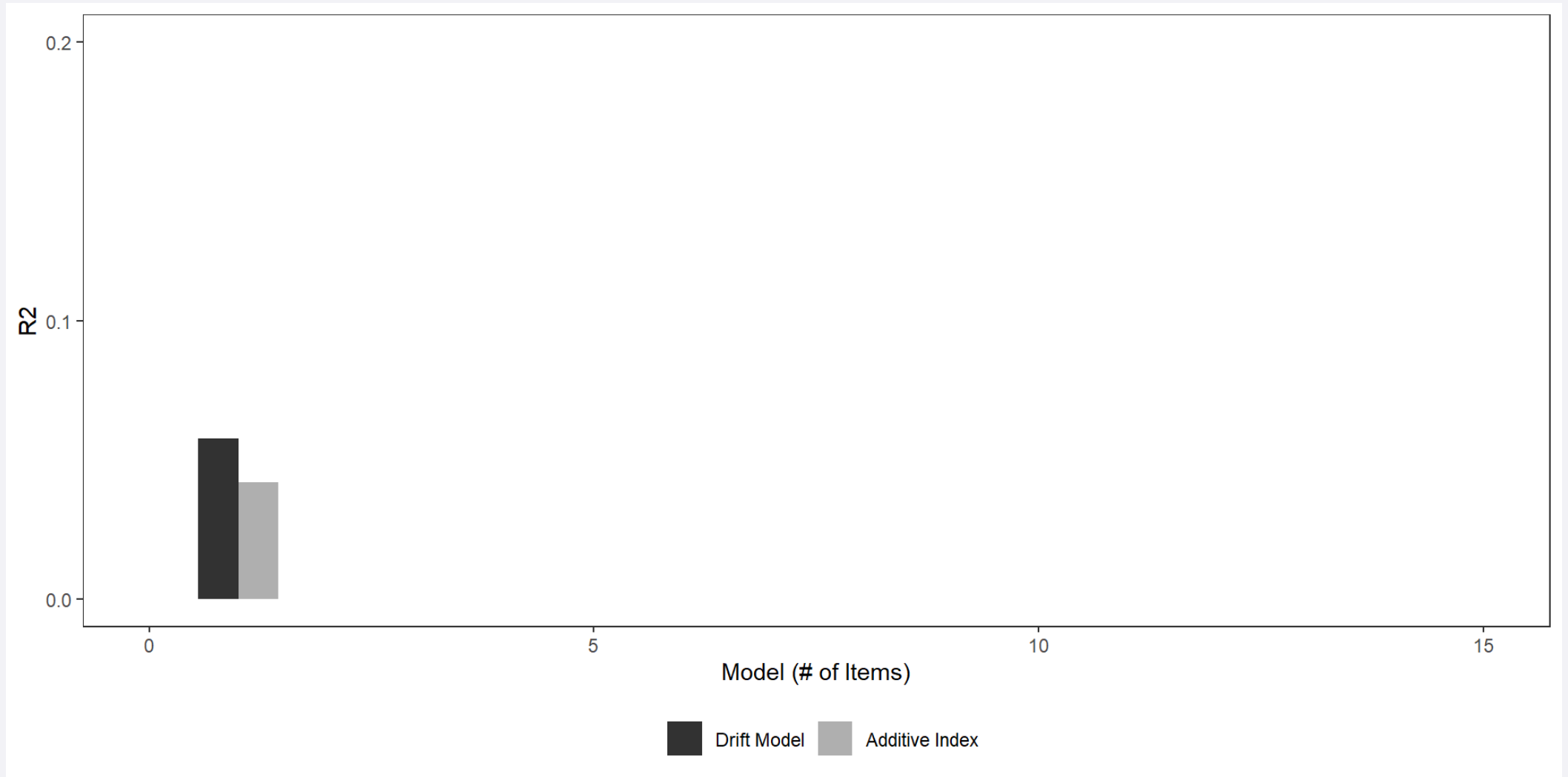# Estimated Latent Knowledge
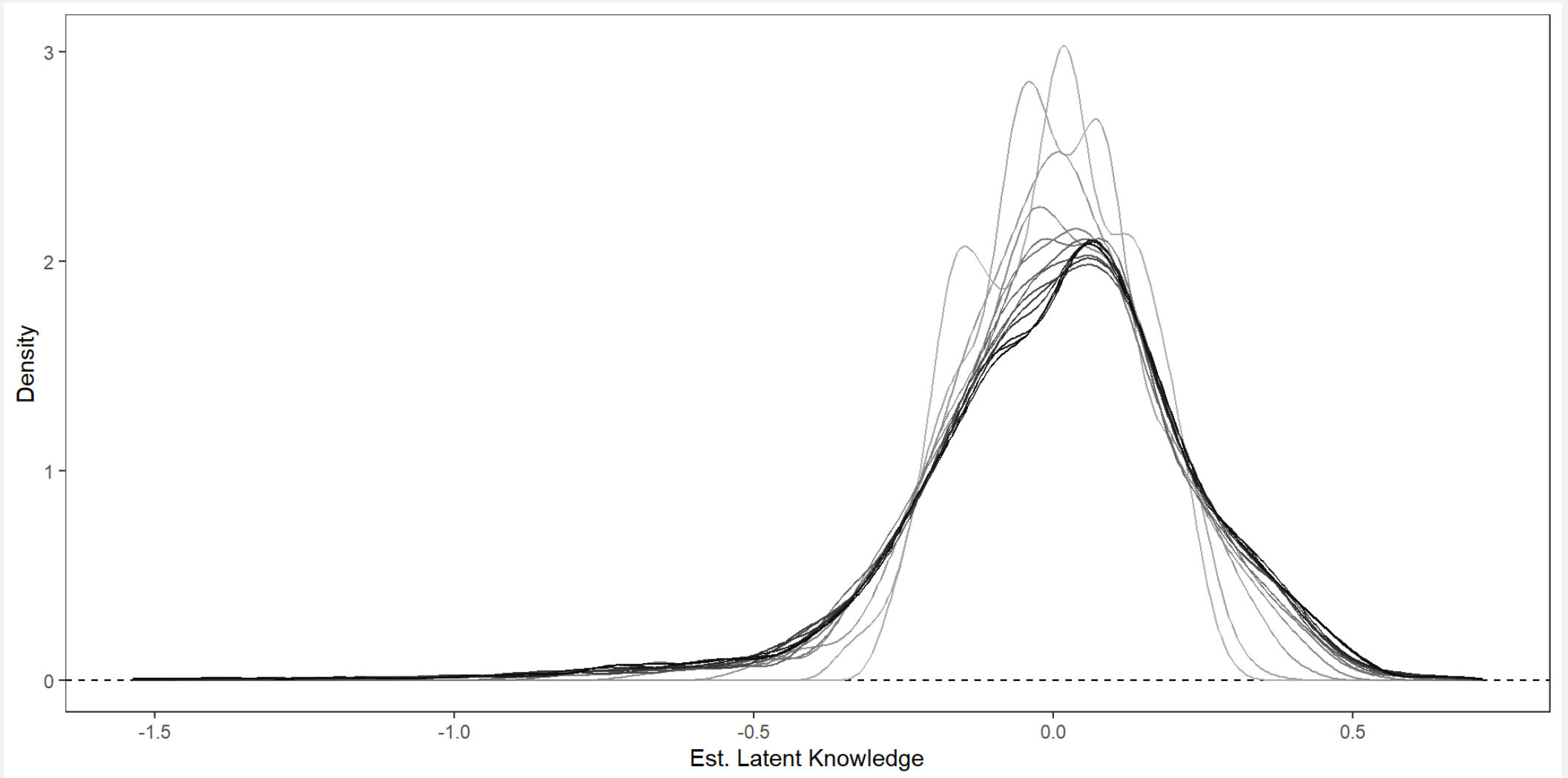
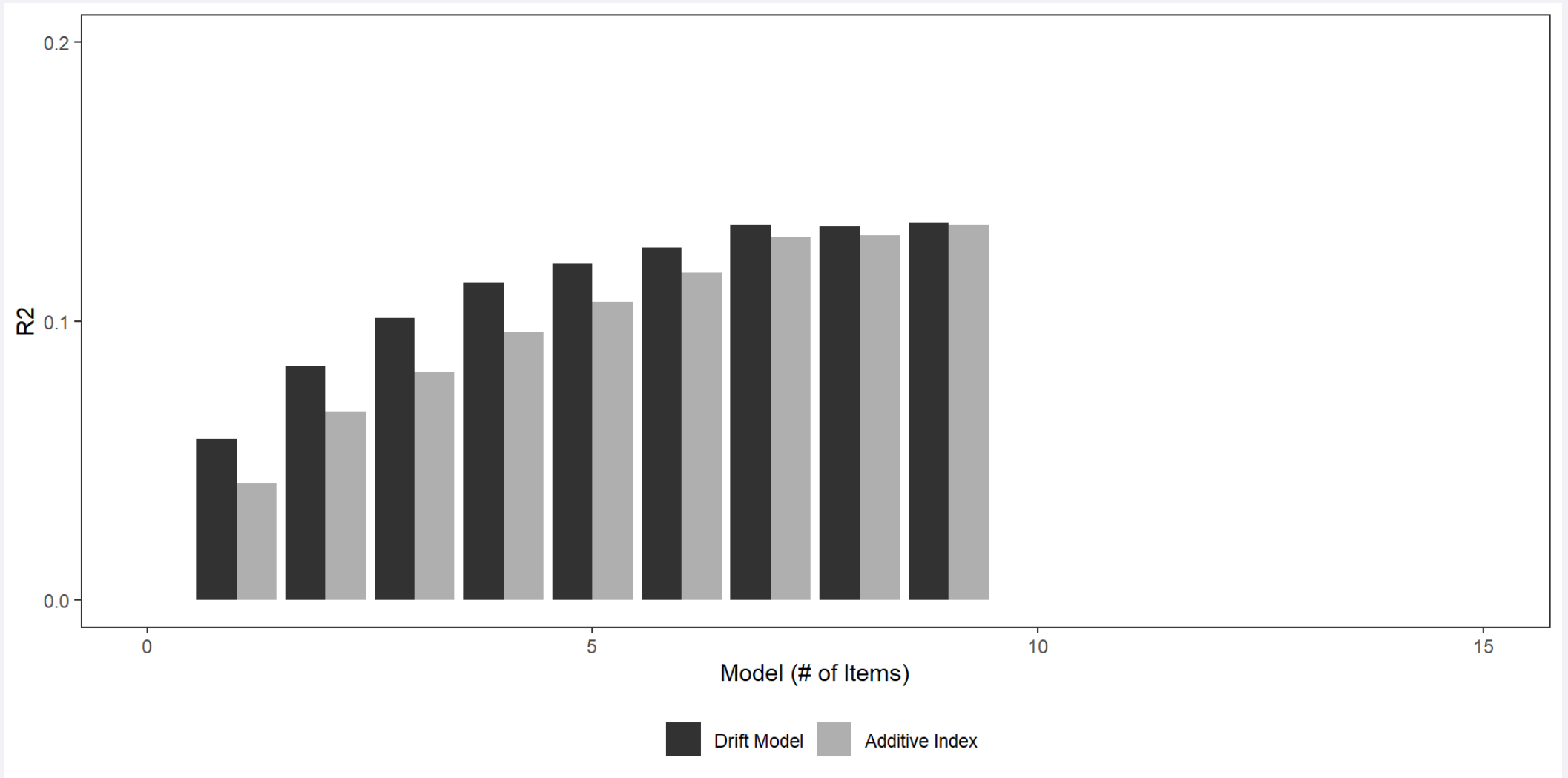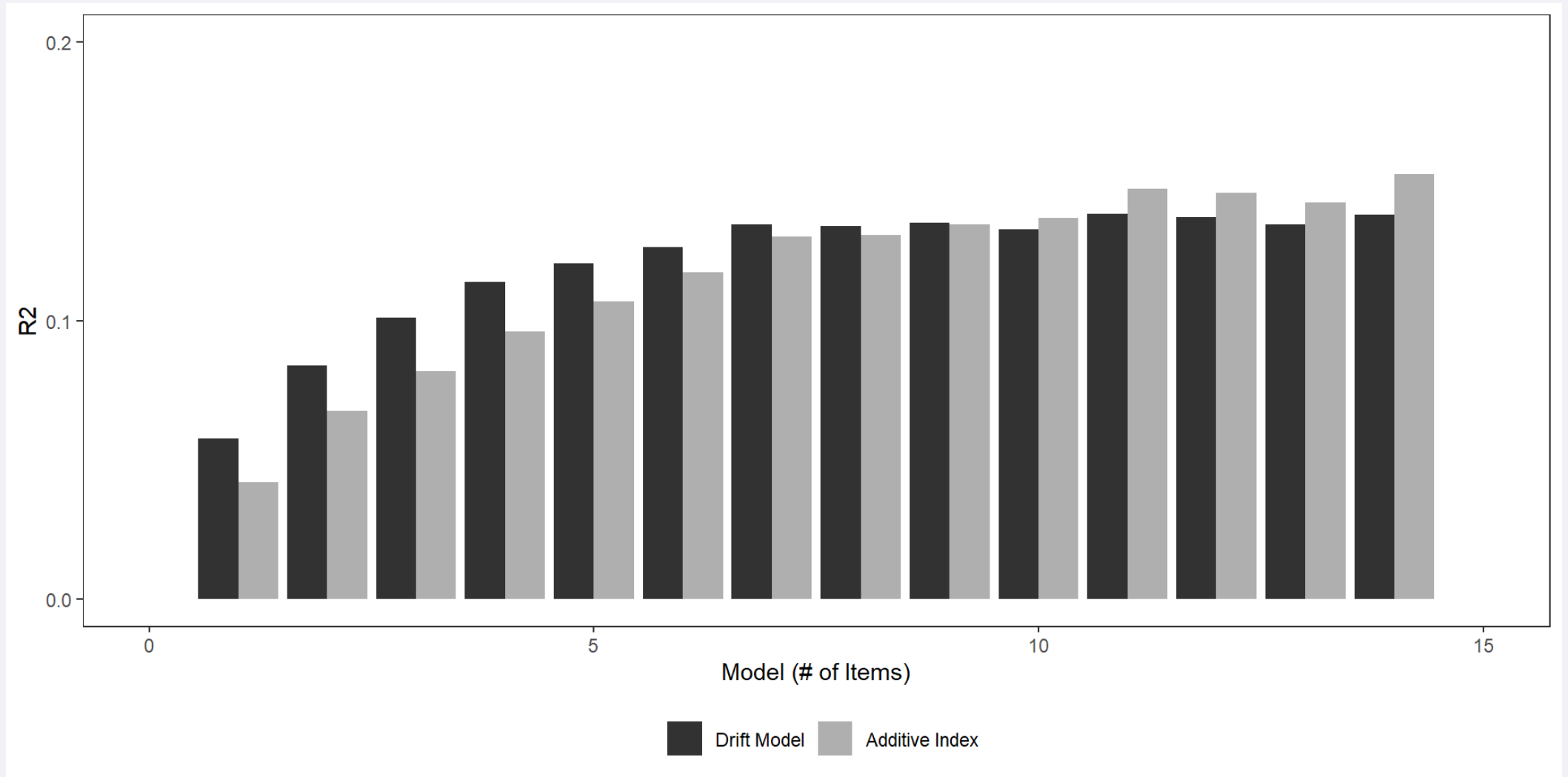# Estimated Latent Knowledge

Estimated Latent Knowledge

Predicting Future Correct Answers
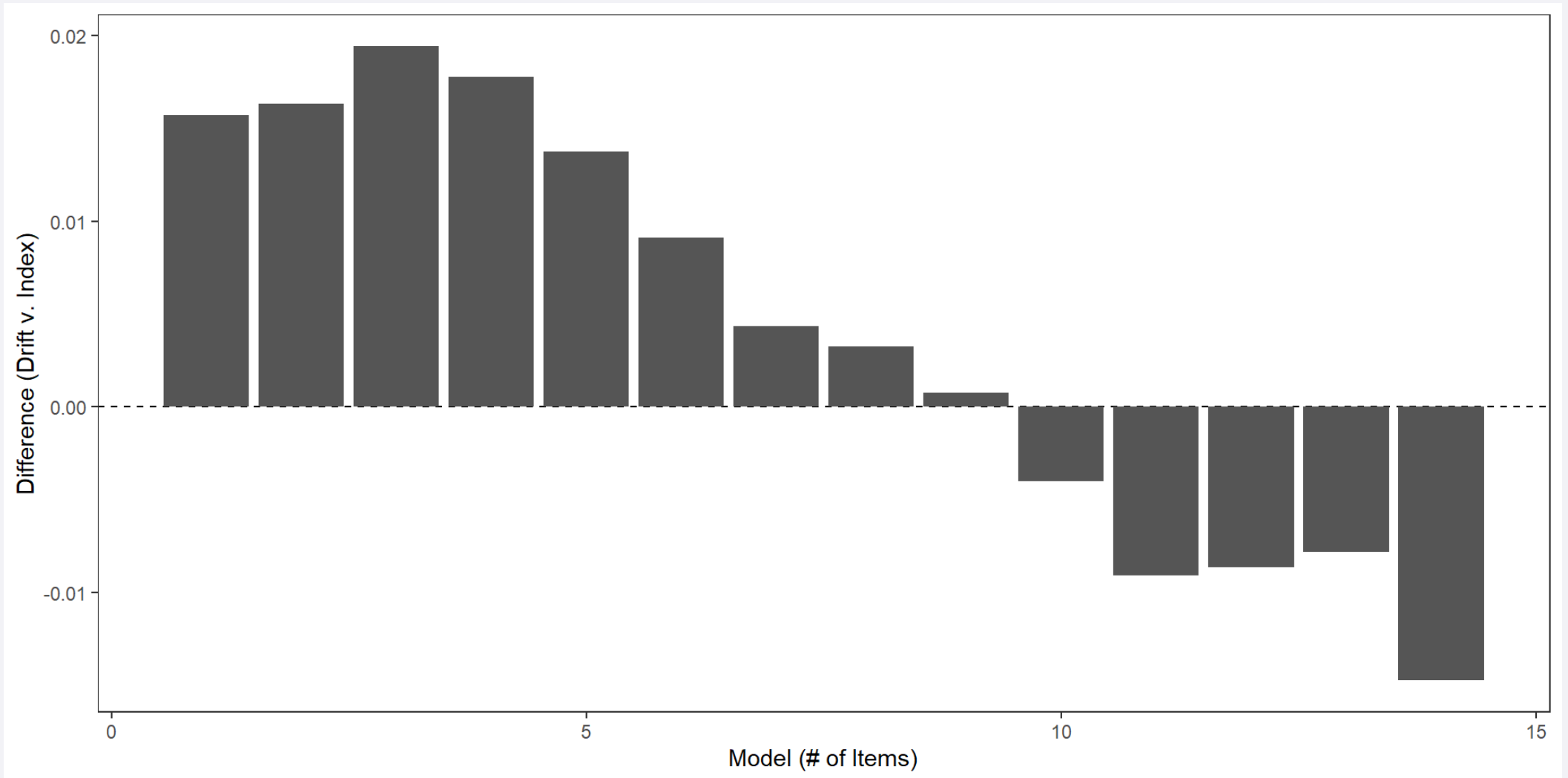
Predicting Future Correct Answers
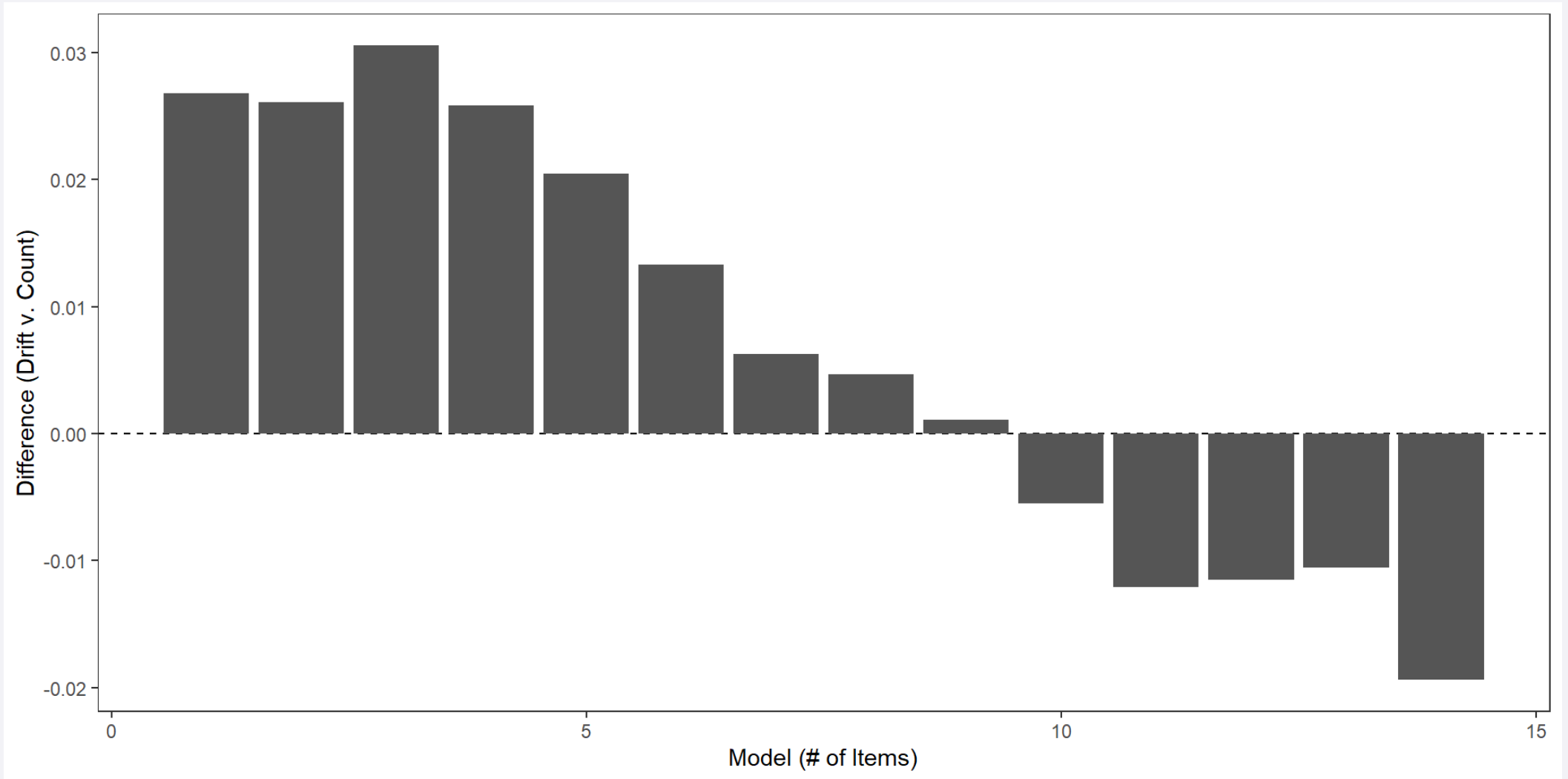
Predicting Future Correct Answers

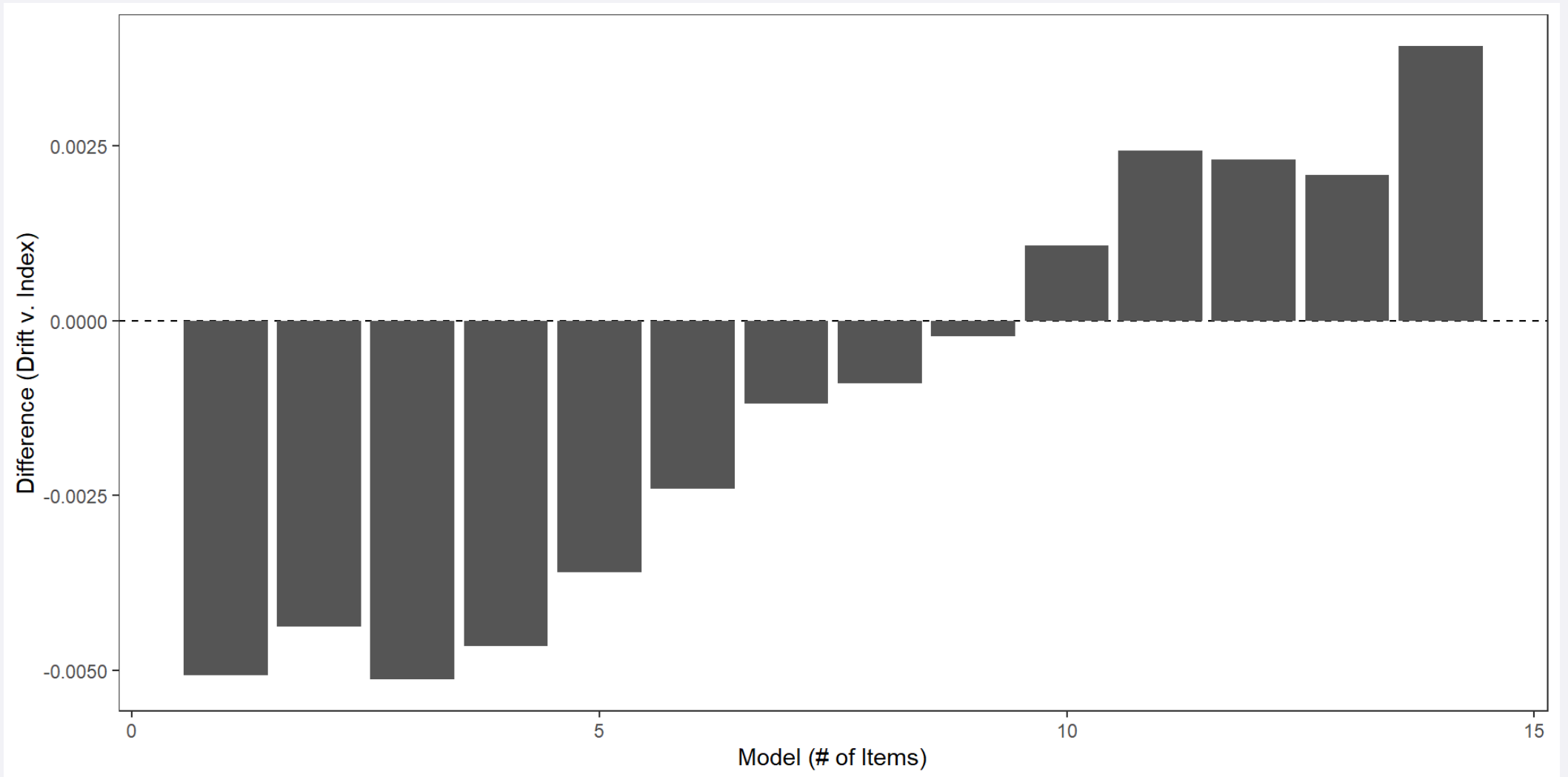# Predicting Future Correct Answers
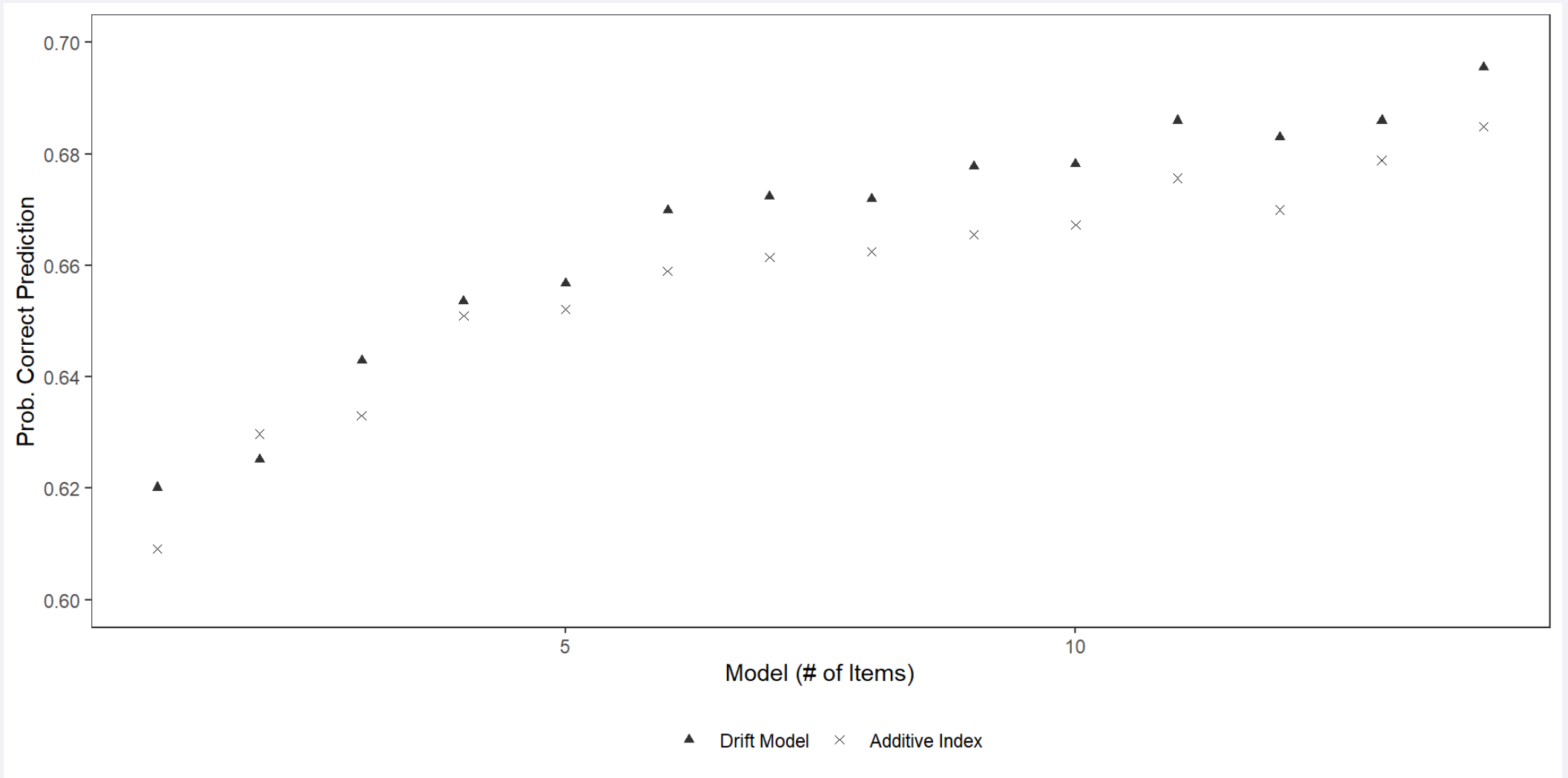
Difference in R2

Difference in Correlations

Difference in RMSE

# Percent of Predictions Correct

Values

Values

- Creativity
- Originality
- Education
- Freedom
- Self-determination
- Independence
- Novelty
- Excitement
- Adventure
- Entertainment
- Pleasure
- Fun
- Ambition

- Success
- Achievement
- Wealth
- Strength
- Authority
- Influence
- Power
- Respect
- Reputation
- Dignity
- Safety
- Security

- Stability
- Defense
- Order
- Tradition
- Religion
- Belonging
- Obedience
- Rule-following
- Politeness
- Courtesy
- Humility
- Gratitude

- Loyalty
- Trustworthiness
- Dependability
- Duty
- Empathy
- Family
- Equality
- Fairness
- Justice
- Environmentalism
- Peace
- Tolerance

Estimation
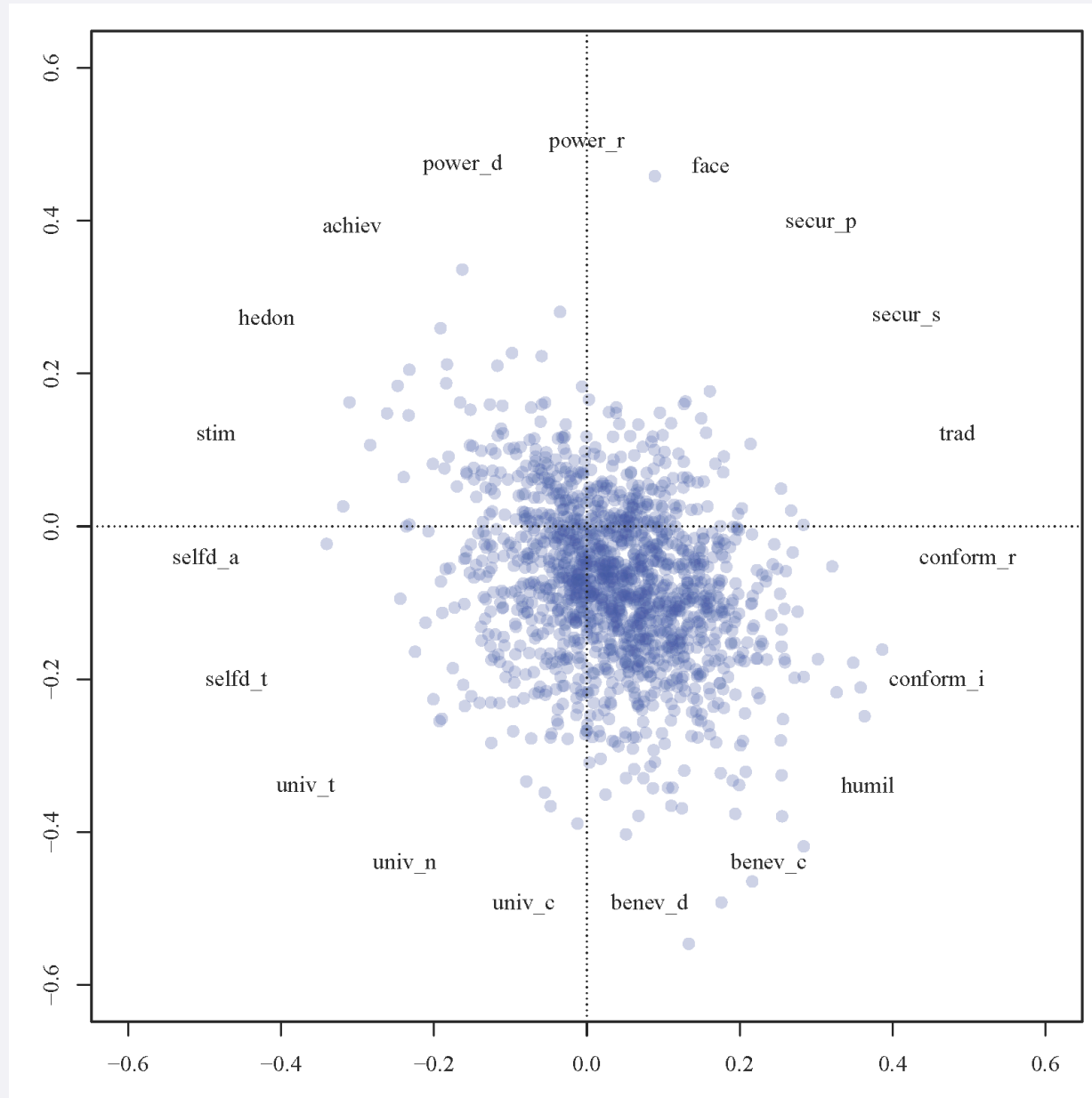
Takeaways

- Timing data provides valuable information

- Easy to implement

- May enable improved estimation of latent traits with fewer survey items

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