Modeling Relationship between Alcohol Policy Perception and Alcohol Consumption in '01 Harvard College Alcohol Survey (CAS)

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Objective

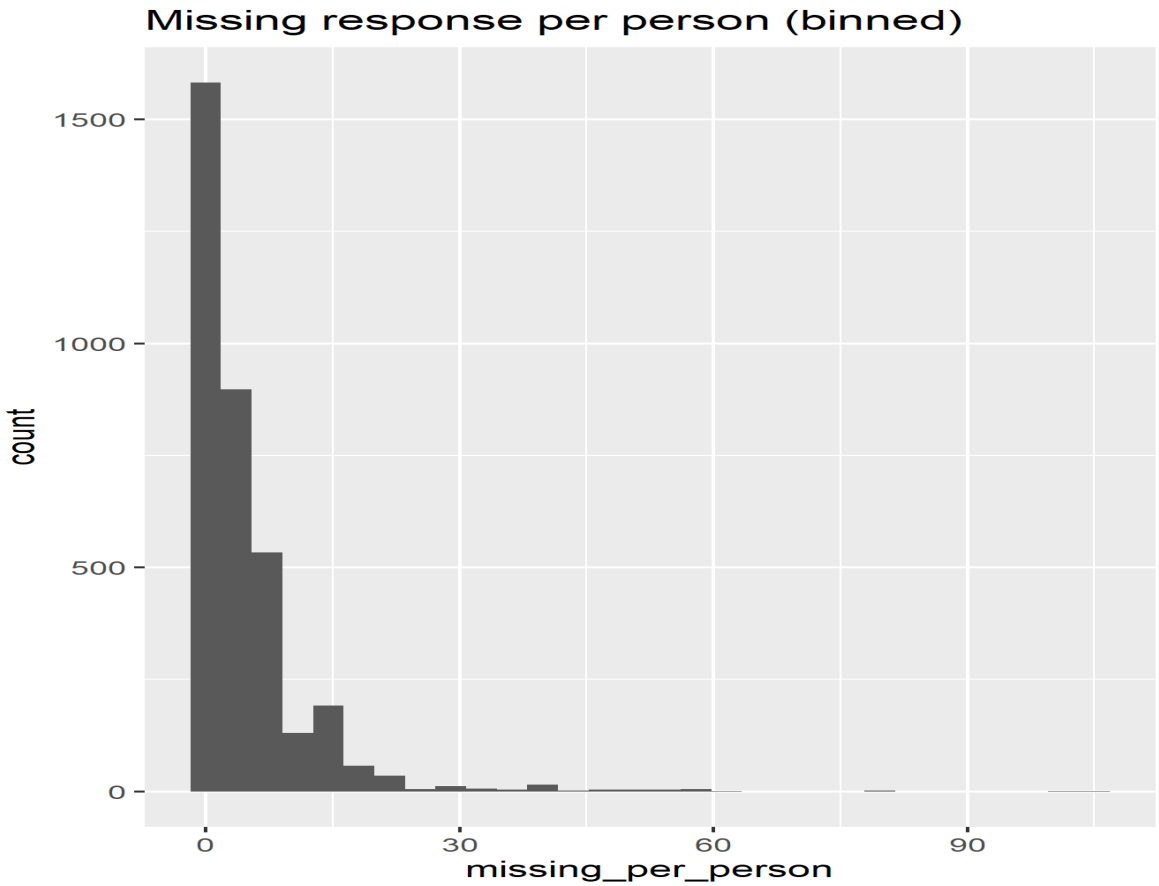
- Data: 2001 Harvard College Alcohol Study (CAS)
  - 10904 participants (unknown response rate)
- Goal: Investigate the correlation structure between **subjective beliefs about campus alcohol policy** and **objective measures of alcohol consumption**
  - *Section B* for subjective questions, *Section C* for objective questions
- Standard survey modeling techniques: factor analysis, structural equations model, item response theory

Data Processing

- Consistent ordering of responses
  - More stringent alcohol policy beliefs (1) -> Less stringent
  - Less alcohol consumption (1) -> More consumption
- Aggressive pruning of the variables before modeling
- Unreliable responses classified based on
  - Response to A7: A (alone) is not allowed with other responses (family/partner/roommate)
  - Response in Section C: participants who chose 1 in C10 and answered C11–C15, etc.
- `WEIGHT01` used as sampling weights (intended for cross-sectional studies)

Missing Reponses

- Missing response rate adjusted for questions that only target certain demographic subgroups

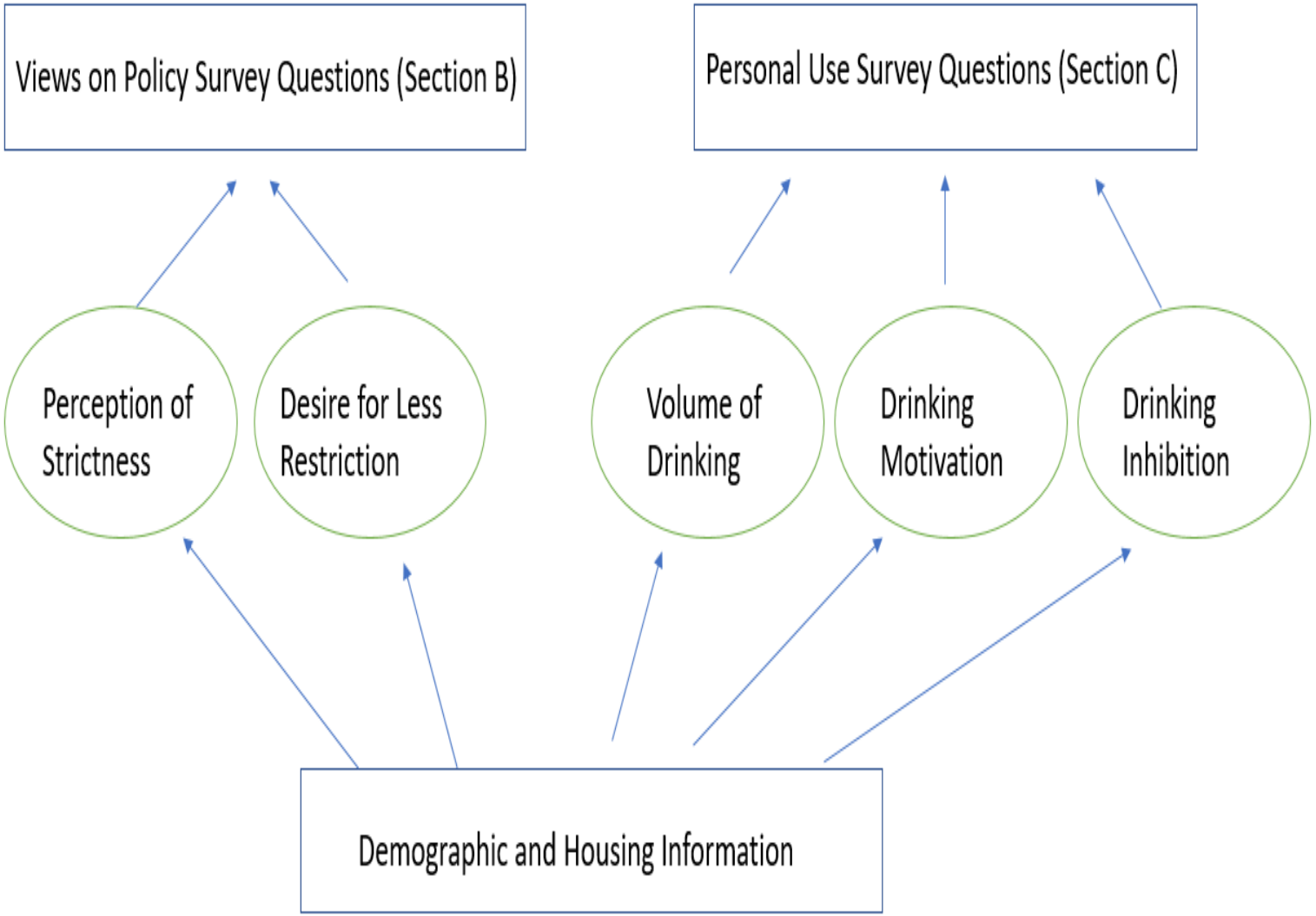


- After adjustment missing rate quite low - around or below 10 percent

Questions Included

- Section B: B1, B3, B5, B19, B21
- Section C: C1, C2, C7, C10, C11, C12, C13, C17, C20, C22
- Predictors/Exogenous: Section A, F5, G1, G2, G3, G4, G7, G8, G13

Graphical Representation of the Model



Structural Equations Modeling (SEM)

- Survey responses X_i can be grouped together as repeated measurements of a lower-dimensional, latent *factors*: alcohol beliefs, alcohol consumption attitude, ...
- Factor analysis identifies the loadings Λ of (scaled/centered) latent variable η_i.

$$X_i = \Lambda\eta_i + \epsilon_i,\ \epsilon_i \overset{iid}{\sim} N(0, \sigma^2)$$

- Structural Equations Models extend factor analysis by specifying within-question correlations and regressing η_i on exogenous Z_i's:

$$\eta_i = B\eta_i + \Gamma Z_i + \nu_i, \nu_i \overset{iid}{\sim} N(0, \tau^2)$$

  - All of our model predictors are directly observed rather than "manifested" by questions: age, gender, etc.
  - Causal interpretation is **not** necessary (though often made!).

Modeling Challenges

- The model is clearly misspecified: Gaussian error assumption is made on ordered response
  - Asymptotic standard errors of factor loading estimators are valid for nonnormal factor analyses (Anderson and Amemiya, 1988)
  - In practice can cause lower goodness-of-fit
- Complete case analysis due to excessive computation in maximizing the full likelihood

Main Results

2 factors corresponding to Section B of the survey

* B1: Perception of strictness in school's alcohol policy
* B2: Desire for less restrictive alcohol policies

3 factors corresponding to Section C of the survey

* C1: Volume of Drinking
* C2: Motivation for Drinking
* C3: Inhibition towards Drinking

Main Results

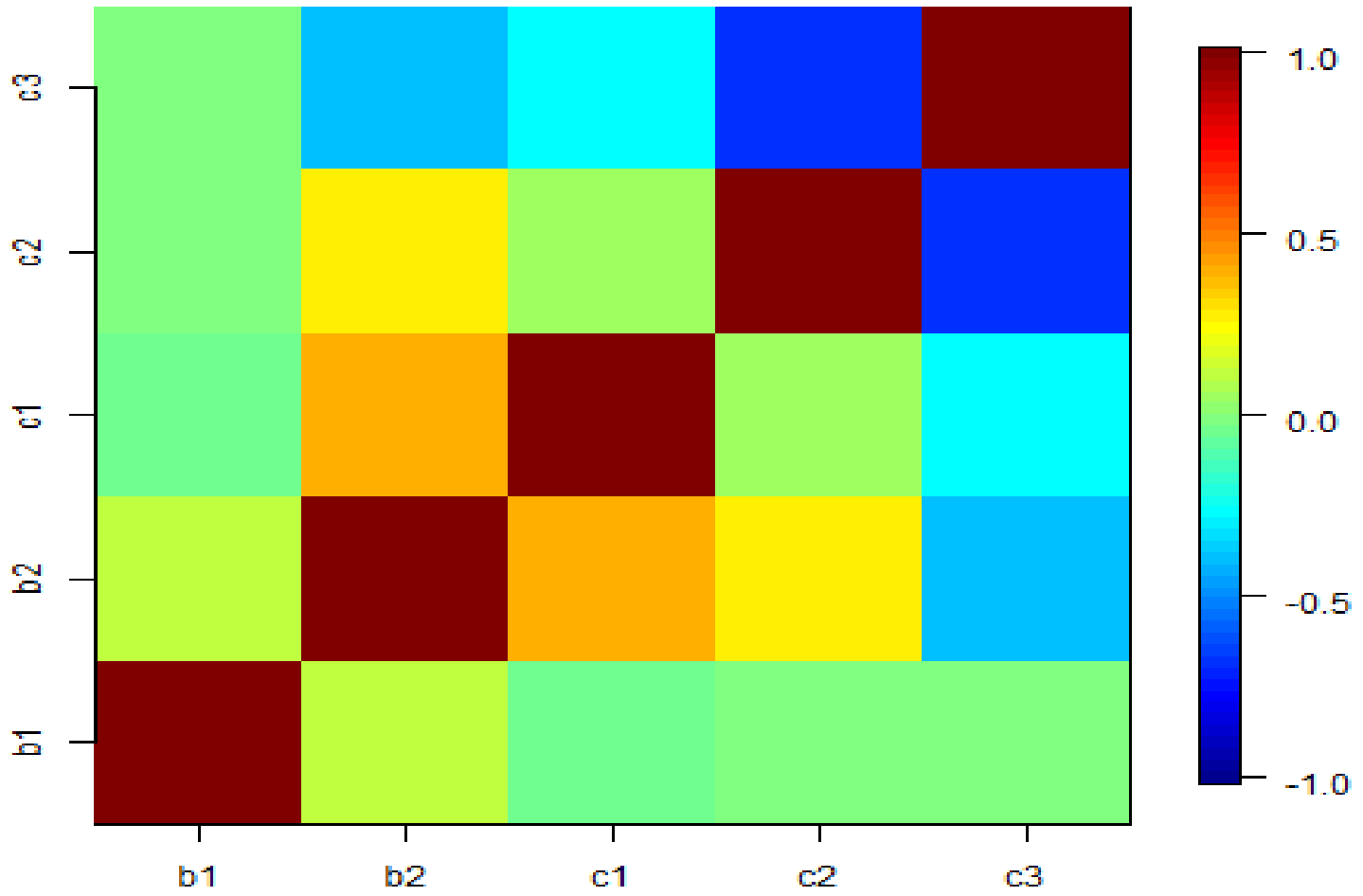


Figure 1: Correlation between latent factors

Interpretation of Factors

- Strictness Perception uncorrelated with other factors
- Desire for less restrictive policy correlated with drinking volume (+) and inhibition (-)
- Drinking volume uncorrelated with motivation
- Motiviation and inhibition negatively correlated

Model Diagnostics

- Various statistics to evaluate model fit in practice (and suggested threshold indicating good fit): CFI ($> .95$), RMSEA ($< .08$), SRMR ($< .06$) (See Hu and Bentler, 1999)
- Goodness of fit statistics for our model:

  CFI: 0.866, RMSEA: 0.041, SRMR: 0.027

Implication: Survey Questions

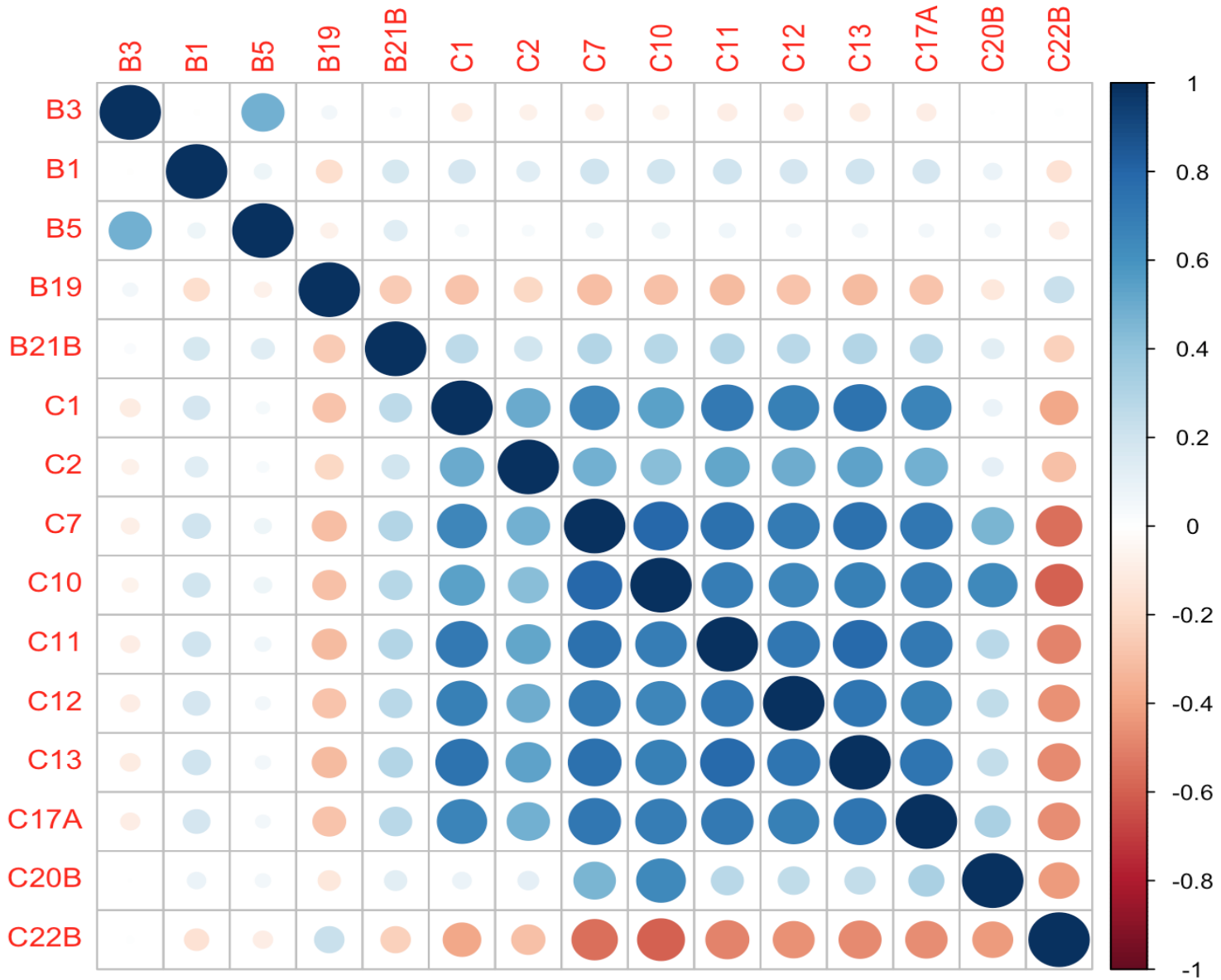


Figure 2: Implied correlation between questions

Implication: Survey Questions

- **B3 and B5**: Students who believe current policy is lenient want even *more* lenience
- **B19**: Minimal drinking age question negatively correlates with alcohol consumption
  - Positive correlation with C22 sub-questions (more dependence on alcohol to resolve problems)
- Between-section correlation is weak except for certain prominent questions: B19, B21

Future Imporvements

- Better model to account for ordinal response
- Theory-driven priors may improve fit of more complex models
- Need information to correct for estimate biases

Reference

- "Asymptotic Chi-Square Tests for a Large Class of Factor Analysis Models," Anderson, T. W. and Amemiya, Y. *The Annals of Statistics*, 16(2), 1988.
- "Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives," Hu, L.-T. and Bentler, P. M. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1999.