

ProblemSet 6

Team2

Mixed Logit Estimation Results and Model Interpretation

1. Model Overview

This document explains the structure, payoff function, and utility function used in the HHA-style mixed logit team formation model. The focus is on interpreting the estimated coefficients from the Maximum Likelihood Estimation (MLE) step and understanding how solo utilities and un-interacted terms shape team formation behavior.

2. Payoff Function

The payoff function represents the observable component of the joint utility derived by two users (i and j) when forming a team. It captures the contribution of individual and pairwise characteristics to the match value.

The estimated payoff function is expressed as:

$$V_{ij} = \beta_0 + \beta_1 \cdot \text{same_country}_{ij} + \beta_2 \cdot \text{abs_rank_diff}_{ij} + \beta_3 \cdot \text{avg_rank}_{ij} + \beta_4 \cdot \text{avg_c_neg}_{ij} + \beta_5 \cdot i_H\text{Rank}_s + \beta_6 \cdot j_H\text{Rank}_s + \beta_7 \cdot i_n_competitions + \beta_8 \cdot j_n_competitions + \beta_9 \cdot i_is_male + \beta_{10} \cdot j_is_male + \mu \cdot \text{same_org}_{ij}$$

where μ is a random coefficient for `same_org_ij` allowing heterogeneity in organizational matching preferences, and $\text{avg_c_neg}_{ij} = -0.5 \cdot (c_i + c_j)$ represents the average solo-utility penalty that reduces the payoff when both users prefer to work alone.

3. Utility Function

The total utility of forming a team is modeled as:

$$U_{ij} = V_{ij} + \varepsilon_{ij}$$

where ε_{ij} is an idiosyncratic error term distributed as Type I Extreme Value. This implies a logistic team formation probability:

$$\Pr(y_{ij} = 1) = \exp(V_{ij}) / [1 + \exp(V_{ij})]$$

The model is estimated using simulated maximum likelihood with Halton draws to integrate over the distribution of the random coefficient μ , allowing unobserved heterogeneity in the effect of organizational similarity.

4. Parameter Estimates and Interpretation

The table below summarizes the estimated coefficients from the final MLE step, along with their interpretation:

Variable	Coefficient	Interpretation
Intercept	0.076	Baseline log-odds of forming a team when all covariates are zero.
same_country	2.687	Strong positive effect: users from the same country are much more likely to form teams.
abs_rank_diff	-0.0018	Small negative effect: teams form between users of similar ranking (assortative matching).
avg_rank	0.0049	Slightly positive: higher average skill increases teaming probability marginally.
avg_c_neg	3.248	Penalty term: confirms users with higher solo utilities are less likely to team up.
i_HRank_s	0.079	Minimal effect: user i's own ranking does not significantly impact teaming.
j_HRank_s	-0.384	Negative: higher-skilled users (j) are less likely to join teams (prefer solo work).
i_n_competitions	0.000	Experience (user i) has negligible effect on teaming.
j_n_competitions	0.000	Experience (user j) has negligible effect on teaming.
i_is_male	-0.305	Male users are slightly less likely to form teams.

j_is_male	-0.282	Partner gender effect: similar direction, smaller magnitude.
-----------	--------	--

Random coefficients:

μ (mean) = 0.0, σ = 0.2

This implies that, on average, users show no consistent preference for teaming within the same organization, but there is mild heterogeneity across individuals.

5. Solo-Utility Penalty and Economic Meaning

In the HHA-style framework, each user's fixed effect c_i represents their reservation utility for working alone. The penalty term $\text{avg_c_neg} = -0.5 \cdot (c_i + c_j)$ introduces these individual preferences into the team payoff. When both users have high c_i values (strong solo preference), the average penalty becomes large and negative, lowering the payoff of team formation.

The positive coefficient (3.248) on avg_c_neg means that higher solo utilities reduce the probability of pairing — the model penalizes teams composed of individuals who both prefer to remain solo. This mechanism corrects for the fact that around 90% of participants typically compete alone, providing structural consistency with observed behavior.

6. Summary of Insights

- Same-country pairing has the strongest positive effect on team formation (cultural or communication affinity).
- Skill similarity matters — large ranking differences reduce match probability.
- Higher-skilled users are somewhat self-sufficient and less likely to form teams.
- Solo-utility penalty (avg_c_neg) captures individual outside options: users who prefer solo work are less collaborative.
- Gender effects are modestly negative, suggesting male users are slightly less team-oriented.
- The random effect for same-organization matching ($\sigma=0.2$) indicates weak but diverse preferences for teaming within organizations.

7. Overall Interpretation

The mixed logit results demonstrate that team formation depends jointly on homophily (same-country, similar skill), individual heterogeneity in solo preferences (c_i), and demographic traits (gender). The integration of person-specific solo utilities (c_i) in the payoff function provides an explicit measure of outside options, ensuring the model accounts for the empirical fact that most users compete solo. The random coefficient on same-organization captures unobserved variation in social or professional connections influencing team choice.