Homework 7

Stat 230A: Linear Models
UC Berkeley, Spring 2025

Due: **May 7, 5:00 PM**

- Your homework must be submitted to Gradescope **as a single PDF file.**

- To obtain full credit, please **write your answers clearly and show your reasoning.**

- For computational problems, **please ensure that your code is included in your PDF submission**. If you need to include a plot, make sure the plot is readable, with appropriate axis labels and a legend if necessary. Results must be shown in nicely-formatted tables. Points will be deducted for very hard-to-read code or plots.

- LME: Linear Model and Extensions textbook by Peng Ding

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1. **Hessian matrix in the multinomial logit model** (LME 21.2)

2. **Poisson latent variable and the binary regression model with the cloglog link** (LME 22.4)

3. **Cluster-robust standard error for Poisson regression** (LME 25.5)

4. **Applied problem**

   The International Monetary Fund encourages economic cooperation among national governments by coordinating mutual agreements about exchange of different currencies. In particular, Article VIII of the IMF's Articles of Agreements stipulates that governments must not place restrictions on foreign currency transfers; in other words, they "obligate themselves to make available to their citizens foreign exchange to settle all legal international transactions" (Simmons, 2000). However, the IMF has limited power to enforce these agreements, and it is unclear how effective they are. Social scientists would like to understand whether signing Article VIII actually decreases the rate at which nations impose foreign currency exchange restrictions. Using data from a closely-related analysis in (Grieco et al., 2009), provided in the file `treaty.csv`, you will fit a model to answer this question.

   Your job is to assess the effect of the acceptance of Article VIII (the `art8` variable) on whether account restrictions were imposed in a given country-year (the `restrict` variable), after adjusting for background covariates (listed below):

```
    covs <- c("shift_left", "flexible", "regnorm", "gdpgrow",
  "resgdp", "bopgdp", "useimfcr", "surveil", "univers",
  "resvol", "totvol", "tradedep", "military", "termlim",
  "parli", "lastrest", "lastrest2", "lastrest3")
```

(a) Run logistic regression of `restrict` against `art8` and the other covariates. Provide an interpretation of the `art8` coefficient in the context of the applied problem. Is there evidence of a strong causal effect?

(b) Now repeat the analysis using robust standard errors with clusters for each country (denoted by `imf_ccode`). Does your conclusion change?

(c) Another researcher suggests refitting the regression with a ridge penalty since there are many variables measured. Do you agree? Explain why or why not in context of the research question.

References

Grieco, J. M., Gelpi, C. F., and Warren, T. C. (2009). When preferences and commitments collide: The effect of relative partisan shifts on international treaty compliance. *International Organization*, 63(2):341–355.

Simmons, B. A. (2000). The legalization of international monetary affairs. *International Organization*, 54(3):573–602.